ENERGY MANAGEMENT

January 1980 No. 40

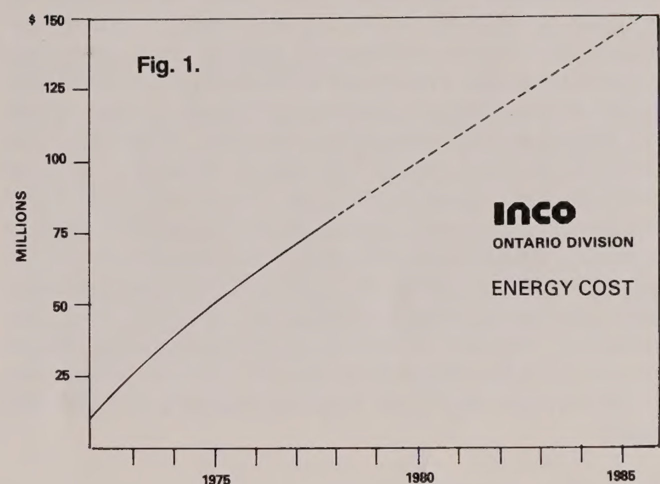
for the conservation of electricity

Saving energy returns Inco more than $3 million annually

Inco, the province's biggest mineral producer — nickel, copper, iron ore, precious metals — is also its biggest single energy user.

The company's twelve mines and ten processing facilities in Ontario consumed, in 1977, 2.03 billion kilowatt hours (kW.h) of electricity, 11.7 billion cubic feet of natural gas, 56.5 million gallons of residual oil, and smaller amounts of light industrial oil, propane and diesel fuel. The cost of this energy exceeded $69 million, and would have been higher except that the company recovered and re-used four trillion (4×10^{12}) Btu's of its own secondary waste heat for process, and space heating.

The increase in Inco's energy costs since 1972 is illustrated in Figure I. This points out the importance of Inco's energy management program in trying to minimize these future cost impacts.



Energy use breakdown

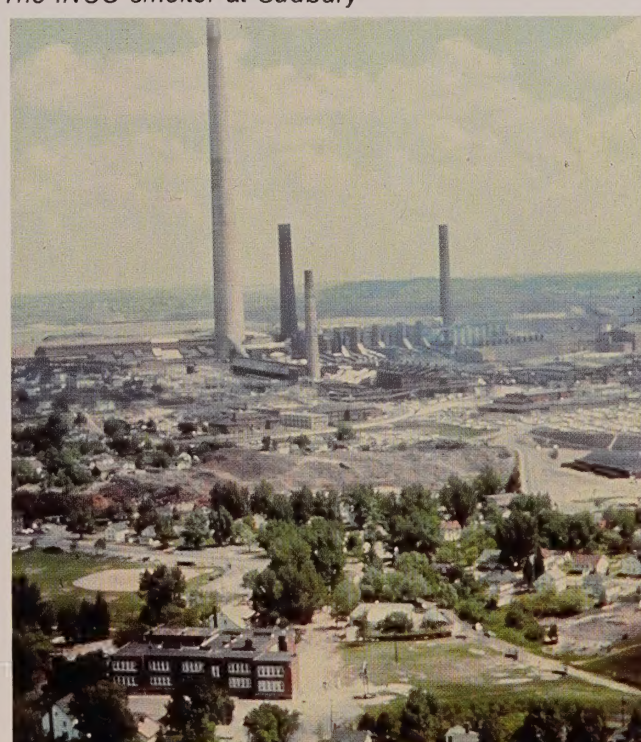
"Electric power is the largest single energy expense in Inco's Ontario Division, amounting to 42 per cent of total energy costs," says J.G. (Gerry) Cullain, Manager, Utilities. This means the 1980 power bill will be over $30 million.

Ontario Hydro applications engineer — northeastern region, T.B. (Tom) Armstrong, indicates that the more than two billion kW.h of electric power used yearly makes Inco Ontario Hydro's largest direct industrial customer. Electricity is required for mine hoisting, air compression, milling, conveying, pumping, electrolytic refining, and, of course, for lighting.

About 26 per cent of energy costs are for natural gas. It's used for concentrate drying, roasting, reduction kilns, copper casting, hydrogen production feedstock and for the direct-fired heating of make-up air for ventilating both underground operations and large plant buildings in winter.

Another 26 per cent of the energy expense is for residual oil, an integral part of the metallurgical processes at the Copper Cliff Smelter and Port Colborne Nickel Refinery. Some light industrial oil is also used for heating and for some processes. Now that more diesel powered "load-haul-dump" mining equipment has been acquired for underground operations, diesel fuel consumption has

The INCO smelter at Sudbury



also increased. Another energy component is propane. It's used for direct-fired heating of mine air in those areas with no natural gas service.

The energy management program

Mr. Cullain points out that Inco began practicing energy conservation in the early 1930s. Waste-heat boilers, designed to recover heat from metallurgical processes, were installed in both the Smelter and Copper Refinery at Copper Cliff and the Nickel Refinery at Port Colborne.

Thirty years later, another major energy recovery system was installed in the Iron Ore Recovery Plant at Copper Cliff. This project maximized energy recovery (and utilization) from the iron ore recovery process (Figure 2).

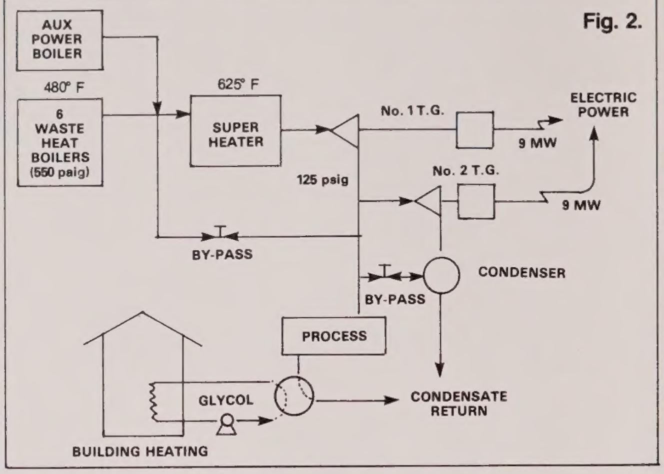
Six boilers provide steam at 550 psig (480°F) from the heat generated by the exothermic reaction in the fluid-bed roasting of pyrhotite. The steam is superheated with gas to 625°F and is admitted to a back-pressure turbogenerator. The steam, now down to 125 psig, is injected to strip the ammonia and carbon dioxide reagents from the nickel-bearing solution thus producing nickel carbonate. The steam surplus to process requirements is admitted to a condensing turbogenerator, where additional electric power is produced. Meanwhile the exhaust, or flash steam from the process is recovered and directed to heat exchangers, eventually being used for space heating with glycol serving as the heat transfer medium. Radiantly heated air is also collected above the plant's reduction kilns and re-circulated to meet the building's space heating requirements. In this way, the maximum amount of energy is wrung from the steam produced in the waste-heat boilers. The two generators in this system having an installed capacity of 9,000 kW each.

Managing electric power

While the above two projects saved substantial amounts of energy over the years, climbing energy costs prompted an investigation by the Utilities Department into the more efficient use of Inco's internal hydraulic generation in 1972. This quickly expanded to cover all electrical use, including peak power control, and became a complete electric power management study.

While Inco's Sudbury area facilities purchase 12,000 kW of 25 cycle power and 220,000 kW of 60 cycle power from Ontario Hydro, its own power supplies are considerable. In addition to the 18,000 kW already mentioned, two

Fig. 2.



25 cycle hydraulic plants have an installed capacity of 30,000 kW and three 60 cycle stations have an installed capacity of 19,000 kW. These plants are located 30 miles west of Sudbury on the Spanish and Vermilion rivers. Inco's total installed internal generation capacity is 67,000 kW.

The Spanish river watershed, covering some 3,000 square miles, is controlled by small dams. Inco's long-range energy plans include studies to determine if additional hydro-electric potential exists on the river (environmental assessment work has already been completed at one potential site).

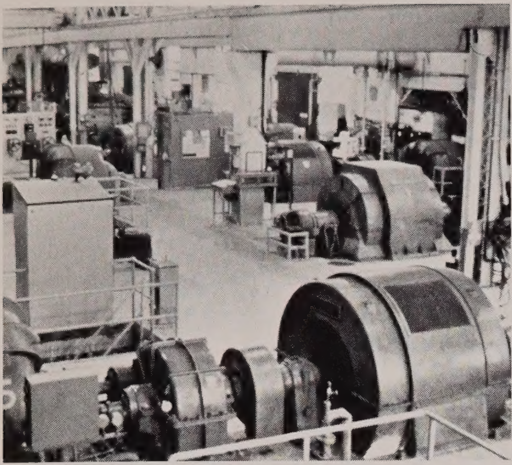
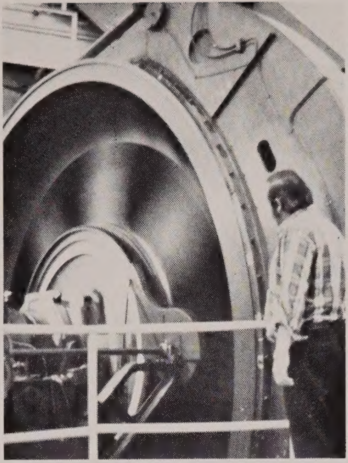
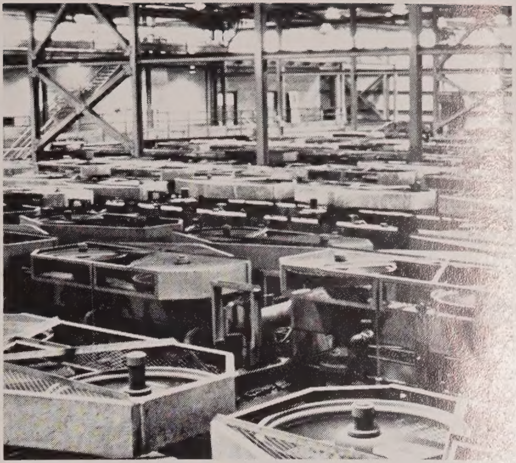
Senior management approval was first obtained by the Utilities Department for the peak power control part of the program since some effect on production levels was expected. Load analysis, using graphic meters, was then carried out at each individual plant and mine. Ways of lowering peak by redistributing loads were discussed with management at each plant and subsequently a load re-distribution system was carried out at minimal cost.

To properly control peak, it is necessary to establish, with accuracy, the peak demand for the following month. At the end of each month, the senior system operator contacts each plant to obtain next month's production schedule. Based on this information, as well as the availability of internal generation, the peak demand for the following month is set. To aid the operator, a digital demand monitor, which provides a running record of purchased power consumption, was installed. The operator maintains the purchased peak by increasing internal

Yearly savings

	1975	1976	1977	1978	TOTAL
Energy Savings	—	$2,068,000	$4,127,000	$3,809,000	$10,004,000
Savings from Peak Control	$359,000	$ 719,000	$ 912,000	$ 889,000	$ 2,879,000
TOTAL SAVINGS	$359,000	$2,787,000	$5,039,000	$4,698,000	$12,883,000

(The figures have been "normalized" for each year, taking production levels, ore grade, concentrate grade, environmental shutdown, weather, plant shutdowns, and strikes relative to the 1975 base year, into account).

Massive electric motor load includes these compressors, above, representing 180 m³/s of intermediate pressure air and 11 m³/s of high pressure air (foreground unit is a 21 m³/s Brown Boveri); Copper Cliff South Mine skip hoist is powered by a 6,000 hp motor (the hoist drum is about 5 metres in diameter, with a cylinder face of 1.8 m — hoist speed is 1000m per minute, and capacity, including rope weight, is 39 Mg); it takes 264 motors, each 25 hp, to drive the 528 Denver flotation cells in the Clarabelle Mill.

generation and shutting down electric power consuming equipment as required.

Mr. Cullain added, "The success of the program is directly related to the energy awareness of the operating plants and the co-operation we have received from them. It is the people in the plants and the system operators that make the whole thing work."

This program considerably improved the purchased power load factor. The monthly average increased from 83 per cent in 1973 to over 90 per cent in 1976. The peak load control also saves energy because permission is now required from the system operator to start large machines (over 500 hp), so these machines run only when needed, and increased awareness of the cost of electric power naturally encourages personnel not to waste it.

Further work on this program involves more detailed understanding of load patterns. Consequently, digital pulse metering equipment has been installed on all sources of power and portable equipment was temporarily installed to monitor energy-consuming loads. Computer programs were developed to help analyze these loads. A computer and four microprocessors were recently purchased. They will be used to develop a model of Inco's Sudbury district electric load, leading to improved peak control and decreased energy use.

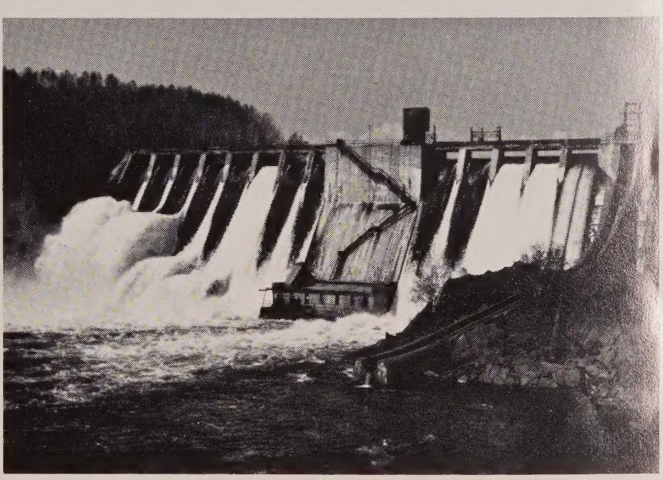
Since 1975, improvements in load factors by peak power control have resulted in savings of $2.9 million.

Another aspect of electric power management was a co-operative research program carried out with Tom Armstrong of Ontario Hydro at Inco's Shebandowan Mine in northwestern Ontario. This mine's 10,000 kW load is purchased directly from Ontario Hydro. Computer techniques were successfully developed to model this electric power load. The load factor of the plant subsequently improved from 0.6 to 0.65, resulting in savings of $25,000 — a clear pay-off for the study, which cost (excluding Inco personnel) $2,000. In addition, the techniques are now being applied to the much larger Sudbury area loads.

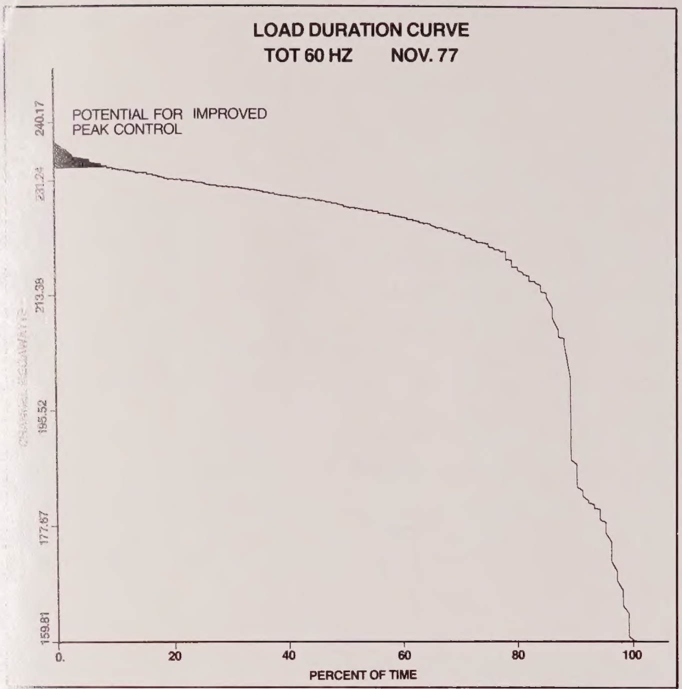
Involving committees

These electric power management activities have more recently been accompanied by the development of a formal energy management program. The policy of the program is to ensure adequate supplies of energy at minimum cost and to minimize energy consumption per unit of production. Guidelines, which deal with attaining increased flexibility of supply, monitoring energy availability and prices, optimizing production efficiency, and minimizing waste, have been established to achieve the policy objectives.

An internal energy committee, chaired by the Utilities Department and composed of representatives of major departments in the Division, had formerly been responsible for energy management policies and projects. This committee, however, recommended its own replacement by a more decentralized system of plant committees formed at each plant or mine area. An energy management co-ordinator was appointed to assess and dir...



Almost half of INCO's internal generation capacity is 25 cycle power, most of that produced on the Spanish River's Big Eddy Dam. Waterflow can reach 850 m³/s, and installed capacity of the three units is 24 MW.



Inco has pioneered the use of duration curves to identify monthly load levels. Every 15 minute load interval is plotted in order of magnitude, the largest first. A "flat" line indicated a high load factor; a "steeply sloping" line, a lower load factor; a rapidly decreasing line from zero time usually indicates inadequate peak load control. A sharply sloping line at the end of the curve confirms that equipment is being shut down when not required for production. This November, 1977 curve is the total of Inco generation and purchases from Ontario Hydro. The "raised" per cent time axis indicates that total load does not go below 159.81 MW. The purchase of the computer and microprocessors will allow improved peak control in the highlighted region under the curve (at the Y axis).

the activities of these committees. The first co-ordinator was K.H. Berno Wenzl, now with Inco's oxygen plant. Along with Mr. Cullain, he prepared the paper "Energy Management at Inco", which is the basis for this publication. Inco's present energy management co-ordinator is B.W. (Barry) Peterson.

Each committee has the responsibility of identifying major energy uses within its own jurisdiction. This process isolated those areas with large potential losses and helped determine the immediate action needed to improve energy efficiency.

The mining area identified electric power as its largest single energy source. As part of their peak power control program, most mines were already reducing skip hoisting when the overall system peaked. Each mine committee discovered additional ways to reduce energy use and shave costs.

They found, for example, that most of the electricity used in the mines was for air compression. One mine reduced compressor use by installing a shut-off valve on the main compressed air line at each mine level. This allows isolation of the large underground compressed air distribution system when mining activity diminishes, which means that most of the main air compressors on the surface can be shut down during the midnight shift and on weekends. A maintenance program to repair all leaks and blank off piping to areas no longer in use was also instituted.

In 1977, the committee at another mine, Levack, compared actual air usage with a calculated requirement. The results indicated substantially less compressed air was needed for production, as well as non-production periods. Compressors were shut down over weekends, valves being shut off and leaks repaired. Annual savings were 4.5 million kW.h, or about $75,000. A subsequent program of compressed air monitoring and post audits throughout the Division has been facilitated by the purchase of a data logger. In addition, computer programs are now being developed to do all calculations.

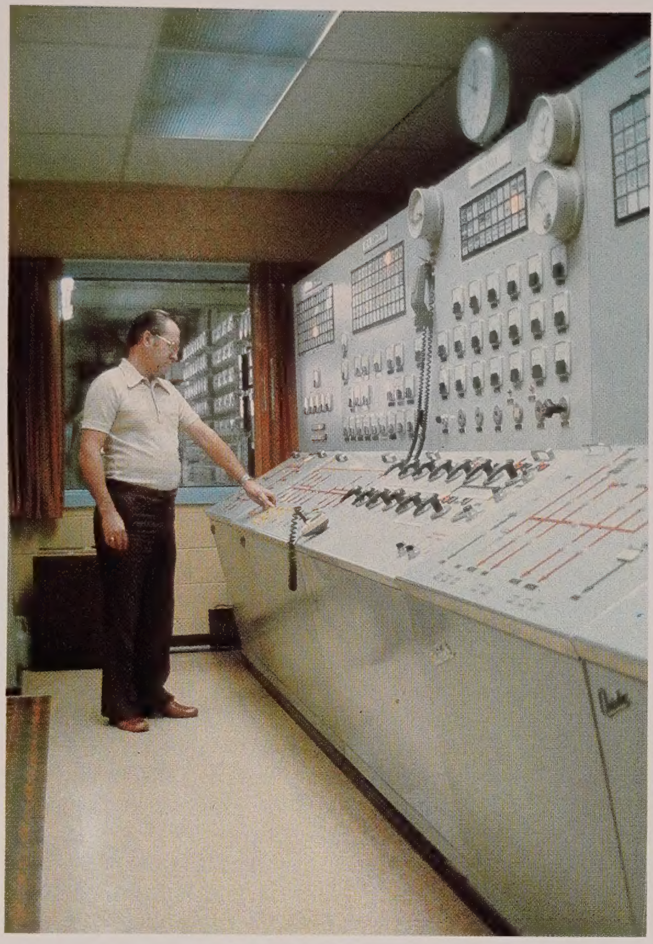
Ventilation is a major energy user in mining. It's needed to clear away fumes from diesel-powered equipment underground and from blasting during mine operation. However, most Inco mines operate only five days per week, with some maintenance activity on weekends. In its energy audit, the Garson mine committee identified a potential saving in both electric power and natural gas by simply reducing mine ventilation on weekends. After carefully checking the effects of reducing ventilation, the shutting off of both fresh air and exhaust air fans on weekends was scheduled, resulting in the shutdown of a total of 850 hp of fan motors. The shut-down also saved natural gas because fresh air at Garson is heated during the winter months. Expense for implementation was negligible, since it only required the preparation of a shutdown schedule and monitoring to ensure that it was adhered to. Energy savings at Garson totalled 1.4 million kW.h and 10,000 Mcf of natural gas, about $35,000 annually. This procedure has now been incorporated into the operations of other mines.

The committees have also been active on the surface plants. At the Port Colborne nickel refinery, a suggestion to insulate the large residual oil storage tanks resulted in substantial steam heat savings. New waste heat boilers have also been installed, and the refinery's electrolyte steam heating was replaced with a natural gas submerged burner which achieved savings in both energy and chemicals.

At the Copper Cliff Smelter, the largest energy consumers are the reverbatory furnaces. Improved draft control on these furnaces reduced their residual oil consumption. Roof mounted burners, with the potential of reducing fuel requirements by as much as 25 per cent, are also being tested for these furnaces. In other areas, improvements in both burner design and controls on the converter and hot metal car burners, cut natural gas consumption.

At the Copper Refinery, electric power use was successfully reduced by 6 per cent without affecting overall copper production. In the matte processing area, the use of electricity for electromagnetic separators was eliminated by using permanent magnet separators.

At both surface and mining operations, photocell controls were installed on outside lights. More efficient lighting units, such as high-pressure sodium, were also used



System operator Bill Beatty at work in #1 substation

wherever possible to reduce lighting power requirements.

Timers were installed to cut the electricity consumption of car engine block heaters — essential for Northern Ontario winters — in parking lots. Use of timers also helps to reduce demand peaks.

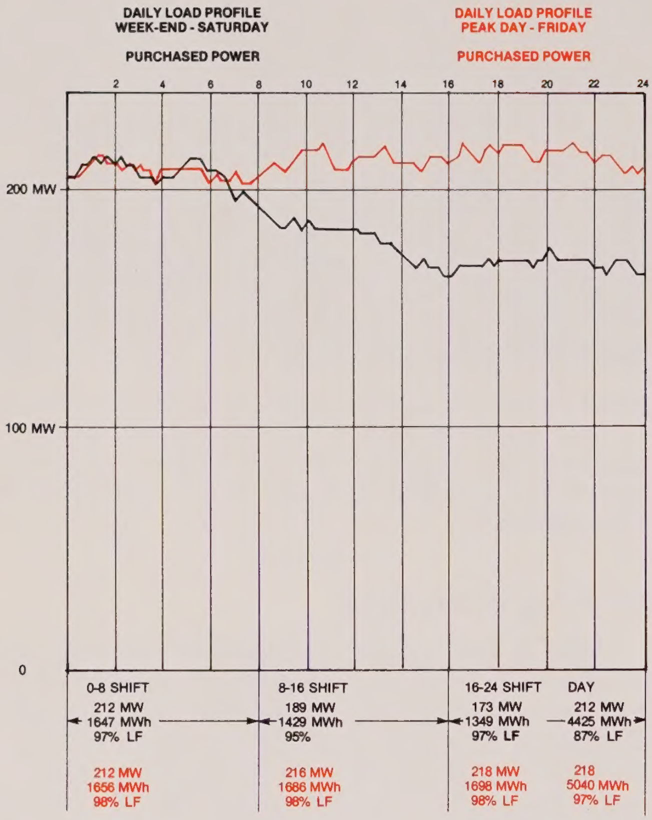
A variety of traditional energy management techniques have been utilized in the program. A project was implemented to upgrade steam piping insulation and to improve steam trap maintenance. Building space heating requirements have been reduced by blocking unused doors and windows, by weather-stripping doors and by upgrading insulation in existing office, laboratory and changehouse buildings.

The energy performance of each operating area, and the entire Ontario Division, is now reported monthly. There is also an ongoing program of employee education to encourage overall participation in the energy management program and maintain awareness of the need to conserve.

Savings are substantial

What's been the result of the program so far? Mr. Peterson reports that his Division's Energy Management program has reduced the required number of Btu's per ton of finished copper, nickel product, and iron ore by 10 per cent. Dollar savings are detailed on page 2. The data has been obtained by referencing the energy rate to the 1975 base year, and applying the annual cost per Btu and annual production. It includes the kilowatt savings from the peak control program.

Switch to high efficiency lighting includes these high pressure sodium lamps in new Divisional Shops.



Inco effectively uses internal generation to maintain a high load factor for its Ontario Hydro power purchases. Profiled are purchases for the peak day and Saturday . . . each 15 minute interval is plotted "in order of time." Note the reduction in load factor after the Saturday 0-8 shift, when underground operations are shutdown for the week-end. Effective load management programs will sustain high load factors during full production shifts, but weekly and monthly load factors may be lower (power is turned off when not required).

Future plans

The value of the program will increase as energy costs continue to climb for the competitive mining industry. In this regard, Inco values its membership in both the Mining Association of Canada's Energy Task Force, representing the mining sector of the Federal government's industrial energy conservation program, and the Industrial Gas Users Association. These associations are valuable in keeping track of the long term energy situation.

Inco has also been participating in hearings before the Ontario Energy Board on rate increase applications which have helped it to more fully understand the intricacies of the supply, costing and pricing of electricity and natural gas. An Inco Corporate Energy Task Force is in operation to study future supply and demand, as well as price, of various energy forms. The Task Force provides senior management with timely and relevant energy information for inclusion in the corporate planning process.

This longer range concern has prompted Inco to investigate other energy areas. A feasibility study, for example, is underway to convert a number of vehicles to run on compressed natural gas, as well as gasoline, with a longer term objective being the evaluation of hydrogen as a fuel. Inco is co-operating with the Regional Municipality of Sudbury in a feasibility study of a plant to produce refuse-derived fuel from municipal and industrial garbage. The Company is also investigating the potential of solar energy in a heavy industrial complex. A possible application is the use of solar energy as a primary or supplementary source of heat for showers and hot water in plant changehouses. And, already underway at a Copper Cliff South Mine is a pilot greenhouse project using waste heat contained in mine ventilation air.

In commenting on these wide-ranging activities, Mr. Cullain says, "Over the next few years, the impacts of various rate proposals, and the generally increasing costs of all forms of energy, will have a significant effect on Canadian mining. To ensure the continuation of a healthy industry, we, and the rest of the mining community, will be pursuing energy management even more vigorously to hold costs down and help stretch out our nation's diminishing energy reserves."

INCO horticulturist Ellen Heale takes temperature readings beside tomato plants inside pilot greenhouse heated by warm air recovered from mine ventilation air.

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ENERGY MANAGEMENT

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for the conservation of electricity

Ontario Hydro Trims Energy Use by $9 Million

TRIM is Ontario Hydro's own massive internal energy management program. So far, in just three years, it has trimmed Ontario Hydro's energy consumption by 21.5 per cent over the 1976 established base (12.5 per cent in 1977, another 6.5 in 1978 over '77, and a further 2.5 in 1979 over '78).

Considering that base year consumption was equal to the equivalent of 922 million kilowatt hours (kW.h), the three year, almost no cost, saving represents more than $9 million to the province's utility (see TRIM savings Chart I, p. 3).

As many large companies will now attest, it's tough instituting an energy management program in an organization of Ontario Hydro's size (more than $14 billion in assets; 28,000 employees; revenues of $2.5 billion).

The rude awakening of the energy shortage crunch in 1973-74 spurred many cost conscious and socially responsible Ontario Hydro managers to embark on their own local energy saving projects. However, there was no central co-ordinating body to pull their results together until 1976 when the Board of Directors approved a comprehensive program proposed by the utility's own Energy Conservation Division.

The division budgeted for the program—dubbed TRIM. The budget included the salary for the co-ordinator, D. L. (Dave) Duncan, and publicity materials (posters, audio-visuals, etc).

"With senior management solidly behind us, our first priority was to find out how much energy we were using," says Mr. Duncan. He soon secured top line management assistance in assessing the total energy used at every Ontario Hydro plant and work location in the province.

As well as the type and annual consumption of each fuel, the information gathered included the type and size of all buildings, vehicles and work equipment. Supplying this information were the organization's seven main branches: Operations; Design and Construction; Distribution and Marketing; Finance; Computer; Personnel and Services (Chart II, p. 4, is a typical branch report).

The data were then used to set energy curbing objectives for the heating, ventilating and air conditioning (HVAC) of all buildings owned or operated by Ontario Hydro; for internal and external lighting; for supply services (water pumping, domestic hot water); and the operation and maintenance of all Corporate leased and owned vehicles and work equipment.

TRIM program co-ordinator Dave Duncan notes that TRIM's energy savings have so far been enough to supply the electrical needs of a city the size of North Bay for a year. Mr. Duncan, at right, with Design and Construction Branch TRIM co-ordinator, Dan Bracken, checks sample of new 8", R 20 precast concrete wall section slated for a new construction warehouse at Atikokan Generating Station.

CHART IA TRIM SAVINGS (kW.h) (OVER 1976 BASE YEAR)

BUILDING & STATION SERVICE ENERGY	1977	1978	1979	Accumulated 3-Year Total	1979 Reduction % From 1976 Operating Base
DISTRIBUTION & MARKETING:					
Central	4,214,200	4,793,250	5,289,386	14,296,836	30.8%
Eastern	7,791,000	10,078,000	12,049,592	29,918,592	24.3%
Georgian Bay	635,508	1,533,918	1,804,856	3,994,282	31.3%
[1] Niagara	10,534,846	10,432,072	13,850,241	34,817,519	21.8%
[1] Northeastern	2,071,521	3,369,660	5,028,915	10,470,096	19.5%
Northwestern	2,874,388	3,947,316	4,119,316	10,941,020	21.9%
[1] Western	3,951,685	4,851,907	5,384,907	14,188,499	24.9%
Sub Total	32,073,148	39,026,123	47,527,213	118,626,484	23.5%
(Includes Production & Transmission Regional Savings)					
PRODUCTION & TRANSMISSION:					
Heliport	181,000	181,000	858,000	1,220,000	6.9%
Nuclear Plants	3,123,456	4,412,656	8,940,956	16,477,068	
Power Systems Div. (Richview SS)	969,530	1,055,262	1,056,776	3,081,569	18.5%
Thermal Gen. Div. (all plants)	55,744,917	67,935,231	69,212,565	192,892,713	24.1%
Sub Total	60,018,903	73,584,149	80,068,297	213,671,349	24.0%
PERSONNEL					
Orangeville C&D Centre	860,346	1,782,066	1,948,066	4,590,478	32.0%
SERVICES:					
H.O. Complex	4,221,739	4,238,509	4,238,509	12,698,757	15.2%
[1] Kipling Complex	2,035,200	5,930,880	7,083,680	15,049,760	23.5%
Sub Total	6,256,939	10,169,389	11,322,189	27,748,517	19.5%
Design and Construction					
[2] Transmission Sys.	84,500	100,000	114,900	299,400	13.0%
[2] Generation Projects	5,067,309	5,100,000	6,227,000	16,394,309	9.7%
Sub Total	5,151,809	5,200,000	6,341,900	16,693,709	9.8%

Notes:

These figures were not adjusted for degree days. On a cumulative basis, this has a marked effect on total savings. Total 3-year savings here — adjusted for degree days — amount to 437 million kW.h (see TRIM results on opposite page).

1. Includes fuel oil savings.
2. Estimated.

The 1976 base consumptions were established in 1977: buildings, 651 million kW.h; transport and work equipment, 271 million kW.h equals 922 million kW.h.
Conversion factors: 1 gallon gasoline = 43.72 kW.h; 1 gallon diesel = 48.79 kW.h; 1 gallon fuel oil = 48.79; 1 lb propane = 6.3 kW.h; 1 MCF of natural gas = 293 kW.h.

Vehicle-Fuel Consumption Statistics - Chart IB				
	75/76	76/77	77/78	78/79
Gasoline (000's gals)	7,489	6,883	6,943	6,933
Diesel (000's gals)	1,031	1,310	1,470	1,673
	8,520	8,193	8,413	8,606
Licenced Vehicles	3,200	3,325	3,500	3,650
Gals/Vehicle	2,662	2,464	2,404	2,358
Reduction Gals/Vehicle	Base	198	258	304
Total Gals (Vehicles X Reduction - 000's)	Base	658	903	1,110
Reduction (percent of '76)		7.8%	10.5%	13.0%
Improved Vehicle EPA by Manufacturer (deduct %)		−3%	−4%	−5.0%
Savings*		4.8%	6.5%	8.0%

*Total savings are equivalent to 50 million kW.h (see TRIM results on this page).

The information, along with a study of other programs around the province, formed the basis for the proposed 10 per cent reduction in total energy consumption in the first year. This target was a composite of savings already being achieved and the calculated potential. It applied to the total energy consumption at each work location, not for each fuel. However, in conjunction with the co-ordinators at each location, specific objectives for reducing consumption of each type of fuel were planned as a component of the 10 per cent goal.

The next step was a listing of the activities required to curtail energy use. This was sorted into the three, by now standard, energy management phases; freebies, minor capital outlay, and major capital outlay.

The TRIM "freebies"

Proven successful by Ontario Hydro, these first year freebies to improve housekeeping and tighten operations of facilities and equipment are worth adhering to:

1. Maintain occupied building temperatures at a maximum of 21°C during the winter season and a minimum of 25°C in summer; unoccupied, they should be 18°C and 29°C respectively.
2. Control temperatures with outside air whenever possible.
3. Regularly inspect and clean all filters and grills; check all heating and cooling systems and air ducts for cleanliness, proper insulation and leaks.
4. Check electrical, gasoline, natural gas, and battery powered equipment for proper operation and maintenance.
5. Eliminate non-essential space heaters and fans; when not in use, turn off all equipment (electrical and otherwise).
6. Trim lighting loads by reducing glaring interior illumination levels and limiting exterior lighting to the minimum required for personal safety and security.
7. Save gasoline by discouraging unnecessary off-route mileage; pre-editing daily route sheets to ensure the shortest route between stops; instructing drivers and operators to turn off engines at every opportunity; ensuring gas tank fill-ups at day's end to minimize condensation and improve gas mileage; keeping vehicles well tuned and maintained (proper wheel alignment, tire inflation, etc).

The TRIM "short-term payback" projects

These included:

1. Installing insulation (rapidly increasing fuel costs make this cost effective in more applications than ever before . . . in furnaces and other heated containers, as well as steam and hot liquid pipes).
2. Using weatherstripping, caulking, and double or triple glazing to cut air infiltration in buildings.
3. Installing controls – timers, photocells, etc. – for lighting, heating, air conditioning, etc., where applicable.
4. Rewiring existing lighting circuits to make control more flexible and efficient.
5. Changing incandescent lighting to more energy efficient types such as fluorescent, where feasible. An example here was the complete relamping of the Hearn GS turbine hall lighting, resulting in a saving of 469 MW.h yearly, with a payback of slightly less than two years. The 170 incandescent 1,000 watt (W) lamps in the 83,000 sq ft hall were replaced with 98

CHART I — **TRIM RESULTS — (Developed from IA and IB)** (Millions of kW.h)

	Additional Reductions Each Year			Yearly Operating Reductions Based on 1976			Accumulated 3 Yr. Total Savings
	1977	1978	1979	1977	1978	1979	
Building & Services	102 (16%)	57 (8%)	17 (3%)	102 (16%)	159 (24%)	176 (27%)	437
Transport & Work Equipment (T. & W. E)	13 (4.8%)	3 (1.2%)	5 (2.0%)	13 (4.8%)	16 (6%)	21 (8%)	50 (1.14 million gallons)
TOTAL	115	60	22	115 (12½%)	175 (19%)	197 (21½%)	487
Target Reduction	10%	6%	3%				
Actual Reduction	12½%	6½%	2½%				

high pressure sodium 400 W fixtures with 72 incandescent lamps retained for instant illumination when returning from an emergency lighting condition.

The TRIM "major capital outlay" projects

Some of these projects are ongoing, some are in the planning stage, and some are contemplated. Some examples:

- A lighting and insulation upgrading of the Buchanan transformer station, near London, with projected savings of 30 kW in peak load and 137,000 kW.h of energy. The new, energy efficient lighting was flushmounted into a new white, acoustical-tiled drop ceiling incorporating parabolic louvres as diffusers. It operates off a master control and three dimming controls. This allows the operator to tune the system to the needs of the moment and his own preference. Added above the new drop ceiling was R20 insulation. Now in place for over half a year, the renovations have been well received by the operators.
- Incorporating energy conserving elements into the 14,400 sq ft construction warehouse at the new Atikokan generating station, including newly-designed, pre-cast concrete "sandwich" panels with R20 insulation values for walls, as well as a totally enclosed unloading ramp.
- Improvements to the Heliport, the Hydro helicopter base, by insulating the underside of the roof slabs to R17 and the office area walls to R15; blocking off east windows; installing . . . storm windows to office areas, four recirculating fans on the ceiling, and a proportional temperature control device as part of instrumentation on the boiler circuit; resealing main hangar door for better fit. Total cost was $12,000 to save a projected 110,000 kW.h yearly worth about $3,000.
- Utilizing new energy conserving measures in new Area Offices such as interconnected, zoned, unitary heat pumps which can quickly move waste hot or cold air from one zone to another. The wall cavity was increased to 4″, allowing an insulation upgrade to R17. The offices have a reduced area for windows, which are double-glazed, hermetically sealed and heat reflecting with a thermal break. Lighting levels match our recommended standards and overhead doors are insulated in these new offices, one of which is completed at Fenelon Falls. Others are under construction at Thunder Bay and Barrie.

Putting TRIM into place

The first year objectives were to take care of most of the freebies and to start on those longer term projects with obvious savings – such as the insulation of uninsulated buildings. The appointment of key personnel became the first priority in implementing these objectives.

Co-ordinators, appointed by the vice-presidents, were selected for each of the seven branches (they were each responsible for their part of the program budget since the resulting savings reduced branch operating costs). One branch, Services, proved so large an area for both surveillance and energy saving that two co-ordinators were required.

To give the entire program the required senior management punch, the branch co-ordinators also formed an advisory committee to liaison with the vice-presidents – the highest operating level of the Corporation. They also liaise with Hydro's Director of Energy Conservation, who chaired the advisory committee, and with Mr. Duncan, who assisted in planning further conservation goals and working to achieve them. The branch co-ordinators in turn appointed resource co-ordinators responsible for the program at each work location.

The resource co-ordinators – the "front line" force of the program – were to audit energy consumption in their physical plant and plan objectives with the help of Mr. Duncan. They were to identify conservation projects, list the means required to get them done, and submit them to line management, either employee "user" subcommittees, or maintenance and other employee specialists. They also monitored the progress of each project and regularly updated Mr. Duncan, as well as their branch co-ordinators. Where time permitted, they

CHART II

BRANCH: DISTRIBUTION & MARKETING
SUMMARY OF ASSETS AND CONSUMPTION REPORTS

LOCATION	Bldg. Sq. Ft.	Annual Consumption Elect./ /MWh	Annual Consumption Fuel Oil/ Gallons	Annual Consumption Propane/ Gallons	No. of Vehicles	Annual Consumption Gasoline/ Gals	Annual Consumption Diesel Gals
Central Region	347,971	7,111	73,580	—	234	350,000	
Eastern Region	1,045,552	20,632	51,434	—	442	617,900	
Georgian Bay Region	171,445	4,399	20,200	—	338	456,000	11,000
Western Region	193,968	7,759	3,200	—	356	525,500	2,500
Niagara Region	2,403,936	19,933	64,656	—	339	487,670	8,200
Northeastern Region	689,411	25,188	27,700	—	398	522,000	12,000
Northwestern Region	220,000	5,072	6,000	300	200	226,300	
TOTAL	5,072,283	90,094	246,770	300	2,307	3,185,370	33,700

Low cost vestibule, left, and 10" clear vinyl plastic strips stopped major heat loss at Bruce Generating Station construction warehouse when truck receiving door was left open. Even closed, loss was substantial through crack around dock leveller. Concave strips overlap, are light enough to let a man or lift truck pass through easily.

CHART III — ELECTRICAL ENERGY SAVINGS — CENTRAL REGION

PROPERTY SYSTEM	ANNUAL SAVINGS TO DATE (December 31, 1977) Base kW.h*	Saving kW.h	%	ACTIVITY
Regional Office				
HVAC system	1,831,600	1,255,700	68	Minimum make-up and exhaust air; increased chilled water temperature; shut-down at night, week-ends; reduced working, and off-hour temperatures; set controls for higher outdoor temperatures; eliminated cooling season re-heat.
Lighting	374,400	60,300	16	Lights removed.
Operating Properties				
Indoor lighting	3,929,300	739,900	19	Re-wired for minimum lighting; reduced lighting levels by lamp removal or using smaller lamps; reduced hours of use.
Outdoor lighting	1,430,800	1,051,400	73	Non-essential lights turned off.
Heating	7,925,900	951,100	12	Temperature changes.
Cooling	500,000	—	0	Rough estimate – Cooling systems not yet assessed.
Areas				
Newmarket	626,400	92,100	15	Lighting reduction. HVAC operation and modifications Timer controls on vehicle heaters (approximately 33,000 kW.h).
Markham	250,520	1,600	1	
Bowmanville	163,900	23,600	14	Reduced lighting and hours of use. Set back, temperature changes.
Brampton	38,500	12,500	32	Estimate only — rented property.
Regional Forestry	10,200	6,800	67	Estimate — reduced hours.
Regional Lines	72,550	19,200	26	Reduced lights.
Totals	17,154,070	4,214,200	25	$50,000 for 1 year $900,000 for 25 years

Note: *Base is 1976 for all except: Regional Office — 1974-1975 average
Operating Properties — calculated loads prior to initial average consumption (approx. 1974)

prepared case histories of their most innovative and most successful projects for use in energy conservation literature.

"We saw their function as a part-time one, adequately performing their assigned chores in as little as one day per month, or as much as two days per week, depending on the energy consumption of their specific jurisdictions," says Mr. Duncan.

Mr. Duncan became the hub of the program. With senior management support he initiated the various liaison activities already outlined which were necessary for line management implementation.

A key responsibility for Mr. Duncan was the motivation of all co-ordinators by arranging continual publicity—articles in Hydro's in-house newspaper and items for the in-house telephone network, the publication of case histories, and the set-up of an awards program. He was also charged with increasing the awareness of these co-ordinators on the "why" and "how" of energy conservation, co-operating with them in planning conservation objectives and schedules, and in establishing uniform reporting systems.

First year events and results

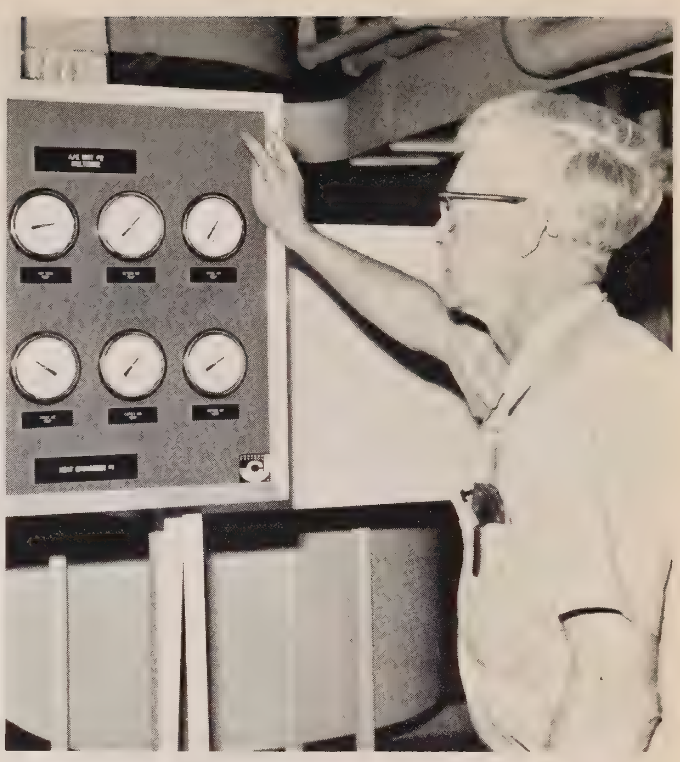
The most important finding was the Corporation's real and voracious appetite for energy. Annual consumption was 922 million equivalent kW.h, much more than the 651 million originally projected. And even projections on use were wrong. Originally, building consumption was to account for 43 per cent of energy use, while transport and work equipment used the remaining 57 per cent. Actual consumption turned out to be 70 per cent for buildings and only 30 per cent for transport and work equipment.

There was a 16 per cent saving in energy for lighting and environmental control (102 million equivalent kW.h) and a four per cent saving in fuel used by transport and work equipment (300,000 gallons, or 13 million kW.h). The 115 million kW.h total was almost double the original 65 million kW.h objective. Even based on the revised 1976 total of 922 million kW.h, this represented a 12.5 per cent saving, well over the 10 per cent target. The estimated reduction in average demand was in the order of 15 megawatts (MW).

The Operations branch accounted for about half the energy savings or 55 million kW.h. The saving highlighted the conservation potential at generating stations, particularly coal-fired thermal plants.

The Distribution and Marketing branch also realized substantial savings, aided by the expertise in its Energy Conservation division. A branch regional office building, for example, cut its HVAC energy bill by 68 per cent simply by adjusting controls and re-setting thermostats (see Chart III). In the Services branch, Head Office cut back energy use by 13 per cent by reducing excessive lighting levels. This reduction was achieved despite the building's initial energy conserving design and major energy saving projects performed in 1976.

These successes were announced throughout the organization, increasing the awareness of the need for



TRIM efforts at Hydro's Orangeville Conference and Development Centre included closer monitoring of HVAC systems. In two years, energy consumption was cut by 29 per cent and demand by 13 per cent.

energy conservation, and helping establish the 1978 target of an additional six percent.

The branch co-ordinators Advisory Committee met four times in 1977 to discuss staff motivation, methods of monitoring results, evaluating effectiveness, and determining the best communication method to reach staff. There were two, two-day training sessions organized for all work location co-ordinators. Corporate lighting levels and van pooling were studied.

The lighting study culminated in a set of Ontario Hydro standards being developed and published in Energy Management #22—now an accepted reference around the provinces – but the van pooling concept was held in abeyance.

Second year results and programs

For the second year in a row, the TRIM target was exceeded with savings reaching a further 6.5 per cent over the previous year. Energy used for environmental control and the lighting of buildings and facilities was cut by 24 per cent, or 159 million kW.h compared to the 1976 base. Fuel saving on the 8,000 vehicles was 6 per cent, representing 366,000 gallons—the equivalent of 16 million kW.h. Overall energy consumption for the year was 19 per cent below 1976.

Analysis of the 1978 savings revealed they could have been higher because the number of heating degree days in that year, compared to 1977, increased (9 per cent, according to the Department of Fisheries and Envi-

ronment Canada). The building energy savings report, however, made allowances for these degree days. The fuel saving calculation took into account the fact that gasoline savings were artificially high since there was a deliberate increased use of diesel fuel.

The lighting level standards established the previous year were implemented and contributed to the savings. Fuel was saved by increasing emphasis on vehicle specifications, tender evaluations, and a careful check of vehicle supply. Radial ply tires and six cylinder engines for cars and trucks under 2450 kg (5400 lb) GVW became mandatory. Hydro's bulk buy evaluation began taking Environmental Protection Act fuel consumption figures into account. Field trials were put in place to test large trucks, subcompact cars, diesel engined cars, and diesel pick-ups. From results to date, Hydro's buying policy for large trucks now specifies diesel engines, and subcompact cars are standard for specific uses.

Good housekeeping and even tighter operations continued to be responsible for most of the savings, but there was greater emphasis on discovering and implementing the second and third phase projects. These included upgrading some Area Offices by lowering the 10 ft ceiling a foot and a half, a space reduction calculated to reduce energy consumption by 30 per cent. Wall insulation was also improved in these offices by adding 2½ inches of rigid insulation to bring them up to R20, the objective being a 50 per cent cut in energy use. Downdraft fans were installed in high ceiling areas such as stores and garages. Timers were installed on the block heaters used for trucks. Energy saving criteria established for new buildings included higher insulation values and reduced lighting. Work also continued on a potential fuel reducing research project – the use of a battery operated aerial device which eliminates the need for running the gasoline engine of the truck while working on lines.

During the second year the branch co-ordinators' advisory committee met to set up a more formal communications program and to participate in an in-depth two-day seminar. The communications program included the design and distribution of eight bulletin board posters, the use of the back page of the widely distributed head office telephone book and publication of key announcements. In addition, a film on driving techniques to save fuel was obtained from Honeywell and shown to employees.

Third year results

Savings were half a percent off the 3 per cent target, a considerable achievement since many of the savings had already been achieved during the first two years of the program.

The TRIM advisory committee held two meetings during the year to thresh out and clarify new terms of reference, to re-assign resource co-ordinators as required, and to plan another two-day meeting of the TRIM co-ordinators. Other items discussed included day (instead of night) cleaning, electric motor efficiencies, the tough-to-adopt vanpooling concept (now being studied by the Personnel branch) and corporate building insulation standards. Hydro's architectural and buildings department was assigned the task of developing and issuing insulation standards for new and retrofit construction.

Building length inflatable ventilating sleeve – punched with holes to let air escape at high velocity along its length – forces cold air to mix with the stratified hot air trapped under the roof, eliminating the need for preheating make-up air at the Pickering pipe hanger shop

The energy required for the environmental control and lighting of buildings and facilities was reduced by 27 per cent compared to the 1976 base, or 176 million kW.h. It was noted that as far as heating degree days were concerned, 1979 was almost the same as 1976, making a correction calculation unnecessary. The three year savings are equivalent to 437 million kW.h.

Vehicles and work equipment used 8 per cent less fuel compared to 1976, a total of 480,000 gallons (the equivalent of 21 million kW.h), proving, as far as the TRIM "Freebies" are concerned, that "practice makes perfect". Calculating exact fuel savings continued to be difficult, as Hydro's area boundaries – and number and variety of vehicles – changed. Three year savings, here, however, totalled 1.14 million gallons or the equivalent of 50 million kW.h.

As indicated in the chart, total savings for 1979 over the base year were 197 million kW.h, a 21.5 per cent reduction. The three year total represents the equivalent of 487 million kW.h. The estimated reduction in average demand was in the order of 21 MW.

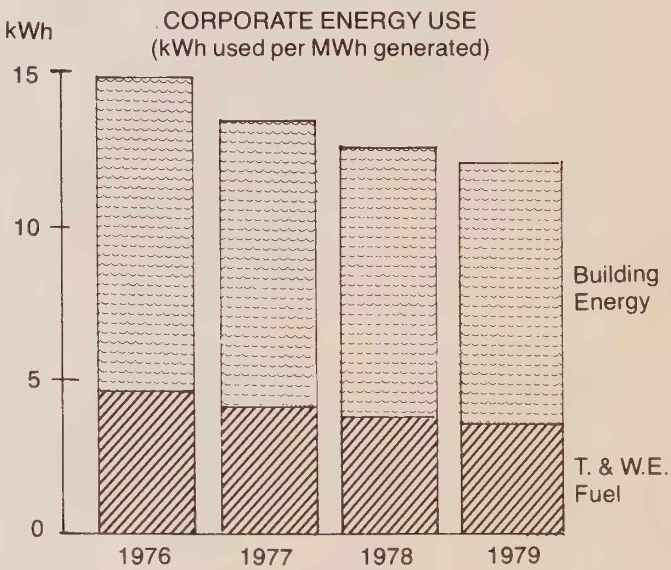
In 1979, corporate changes led to the formation of a new TRIM advisory committee. The two-day meeting of

Retrofit of Hydro's area offices under TRIM included upgrading of wall insulation to R 17, including this one in Orillia.

Energy saving ducts extending to work bench level effectively keep particles out of the air and take in heat – later recovered – generated by welding at the Pickering Generating Station pipe hanger shop.

resource co-ordinators continues to act as a strong program incentive. While a large potential for energy savings still exists in many branches, and other locations require motivating and monitoring to maintain reductions, TRIM continues as a model for government and other utility energy conservation programs. A refinement has been added in that the 1976 base has been discontinued because of the impossibility of keeping up with physical changes. In its place, a new standard has been developed, kW.h used per MW.h of generation. Chart IV details TRIM's success in terms of the new standard.

An announcement of the 1979 success was again made by the President's office, an external news announcement was prepared, and TRIM results were once again incorporated into the 1979 annual report – all elements designed to maintain awareness of TRIM.



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ENERGY MANAGEMENT

August/September 1980 No. 44

for the conservation of electricity

Energy costs have become increasingly important to hospitals. In fact, energy conservation was this year's Canada Hospital Day theme in May. Much has already been done. See our EM#17, "Thunder Bay hospital's $5,000 energy conservation program yields $36,000 in first year of operation," #24, "Four year savings close to 30 million kW.h at McMaster Health Sciences Centre," and #26, "Staff support turns Westminster Hospital's minimum cost program into a $150,000 winner." And, in Toronto, The Wellesley Hospital — with a $1 million energy bill — cut energy costs by instituting regular steam trap maintenance, eliminating fluorescent lamps and replacing some regular lamps with the more energy efficient types. They installed a glycol heat exchange system to recover heat from the kitchen ventilating system and an automatic energy control system to operate heating and air conditioning systems. In the latest available year-to-date figures, Wellesley's electrical energy use dropped from 14.1 million kW.h to 11.5 million kW.h, a 22.6 per cent decrease. In every case, hospital staffs have been encouraged to help by switching off needless lights and equipment that isn't operating. This issue contrasts the approaches of a large metropolitan hospital with that of a smaller urban unit in combatting energy costs.

Energy management saves $362,000 this year for the Hospital for Sick Children

Careful planning by the Hospital for Sick Children (HSC) will save the eight hundred bed hospital in Toronto $362,000 in energy costs this year.

Because a hospital is occupied day and night and requires special measures such as straight through ventilation in the operating suites, such large savings are spectacular.

The focal point of HSC's program is its Director of Plant Engineering, James (Jim) Finlay. His department operates and maintains the world famous sixteen storey, 1.2 million square foot facility. Jim is vice-chairman of the Ontario Hospital Association's Engineering Executive Council and chairman of its Energy Committee.

He credits the program's success to preparation and a willingness to bring in specialists. HSC had begun planning the administration backbone for such a program in 1971, gaining the experience in the meantime to carry out the consultant's suggestions to the letter.

"Retirements and attrition enabled us to upgrade staff and train them in efficient building operation. We prepared procedural manuals on every aspect of the plant to enable us to operate and maintain the building during staff turnovers or reassignment."

His department carried out limited "low cost" and "no cost" savings — relamping with low wattage tubes, shutting down fans, lowering domestic water temperature, expanding the ventilation comfort zone — with encouraging results.

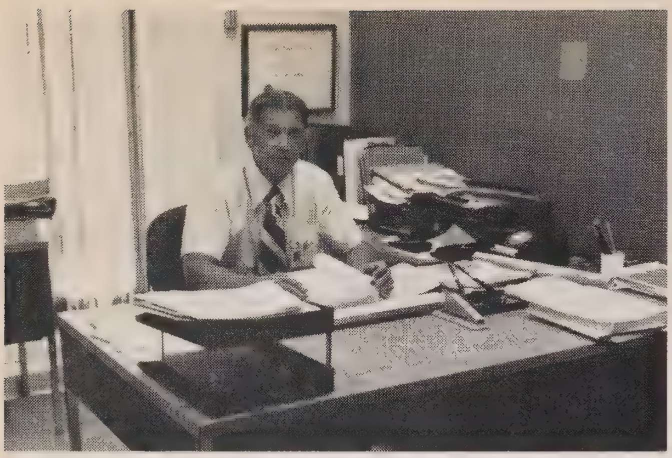
"While our overall area increased 30% by new construction during this time, our energy use increased by only 3%," enthuses Jim.

Hospital turns to simulation

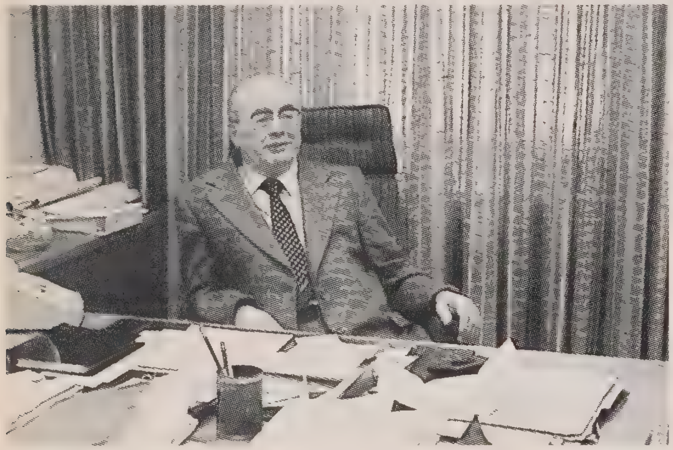
By 1976, however, . . . "there were no more easy dollars to be saved and it was time for the specialists," remembers Jim.

The required Board approval was obtained, recalls assistant hospital administrator, Don Long — who works closely with Jim — "Our Board was very receptive. Since a hospital our size spends over a million dollars on energy each year, even a small saving represents a lot of money."

Sick Children's, a downtown Toronto landmark, saved more than 6.5 million kW.h in energy and more than 8000 kW in demand.



Hospital for Sick Children's plant engineering director, James Finlay, reviews the energy report that cut the energy budget.



Assistant administrator Don Long credits Board approval with giving the energy saving project the stamp of importance.

Several consultants were then asked to submit proposals and were supplied with operation information and granted access to plant documentation.

Mr. Long adds, "We had two priorities; one, the consultant had to have some appreciation of the complexities of hospital operation and two, he had to be able to do a detailed computer analysis. Since we had done the straight-forward work, it was essential the consultant could utilize the comparative approaches a computer makes available."

HSC selected H.H. Angus & Associates Limited of Toronto. Their report was to include the entire hospital, except for the nurse's residence and parking garage.

"We were impressed," says Mr. Long, "with what several of the consultants had to offer. But the Angus people had designed or renovated over 200 hospitals and had a good deal of experience in computerized simulation."

Hospital participation was key

The consultants were issued with the temperature limits of various departments, such as the children's undressing areas (well above the normal energy saving standards in winter) and the burn treatment unit (90°F to prevent massive body heat loss from patients).

"The participation from Jim Finlay's department helped immeasurably," says Ed Matthews, of Angus. "They were a pleasure to work with. They had done their homework and were a virtual storehouse of information about HSC."

Pertinent data was put through the computerized energy simulation program using a terminal at the consultant's office. Various temperatures, air volumes, lighting loads, and selective equipment shut downs were simulated for their effect on total HSC energy consumption.

The resultant several hundred page study document, along with a two feet thick stack of computer printouts, led to recommendations eventually approved by the Board.

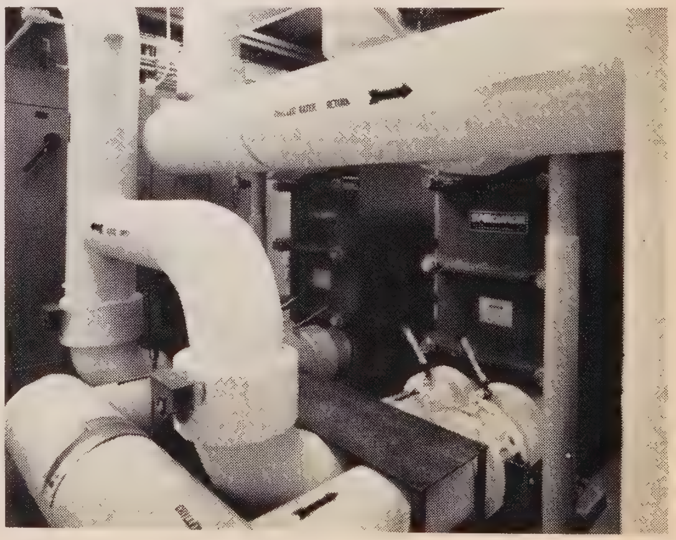
On the basis of the study, building air volumes were cut 30 per cent; the 180,000 sq. ft. University Wing was converted to variable volume air conditioning; and the remaining fixed volume systems were reduced from 93,000 to 65,000 CFM. The comfort range was widened, limits now being 78°F in the summer and 72°F in winter.

Ventilating system operating hours were cut back and the main system for each floor shut down after hours, Local air conditioning systems were installed to handle needs when a small area of any floor — security or some computerized operations had to remain open beyond the curfew. Incoming air is now pre-heated using heat recovery systems installed in the ventilation exhausts.

Extending measures previously instituted, the consultants recommended rescheduling building cleaning to reduce the number of lights burning at night and replacing fluorescent lights with low wattage 4 ft. tubes.

Finally, domestic water temperatures were lowered from 140°F to 120°F and metering was installed to trace energy use in special areas — the kitchen, the nurse's residence, the Elm street Wing, the University Wing, and the Gerrard st. Wing.

Plate heat exchangers allow the pre-conditioned coil in certain ventilation systems to be "connected" to the refrigeration system in the summer. In winter, the exchanger is isolated and the pre-conditioning coil is connected to a heat reclaim coil in the system exhaust. This innovative, modified glycol heat recovery system has attracted inquiries from overseas.



It took a year to implement the consultant's suggestions. After they were in place, a further recommendation to investigate peak electric demand saving may provide savings even beyond those currently anticipated.

Internal measures taken

Once the recommendations were approved, Mr. Finlay's tight organization started paying dividends.

"Right away we appointed a full-time energy co-ordinator to keep track of both energy metering and renovations as they were made. We appointed one of our best men and had him report directly. We also established a monthly report format, something which any hospital undertaking a similar program should start on immediately."

At the consultant's suggestion, HSC installed metering for the steam, domestic hot water, refrigeration and lighting to support the co-ordinator's work, with special areas (kitchen and laundry) being sub-metered. This kept track of the program's success and provided a factual basis for more changes,

These measures paid unexpected dividends. Recently, Mr. Finlay noticed excessive natural gas use on a monthly report which was tracked down to the incinerator. The subsequent changes saved $10,000 annually.

Co-operation beyond expectation

After more than a year of progress, the plant department realizes the importance of staff co-operation. Jim says, "The energy team in our Hospital — in fact, any hospital — should be extended to all employees. They have to bear the minor inconveviences associated with the program at the same time insuring that changes are consistent with patient welfare. The patient, after all, is our prime interest."

Both men agree the program gained acceptance beyond their expectations. Says Mr. Long, "I think the critical part was Board approval, which cleared the way and highlighted the importance of our project. We tried to impress on our people that saving energy would save the hospital, and the taxpayer, a good deal of money. We didn't have to do much convincing! Jim's articles in our newsletter prepared people for what was about to happen. In most cases, the response was co-operation and understanding. The PR departments' light hearted approach helped.

"We kept Medical Department heads informed in advance. This was done on a department-by-department basis, to ensure that our temperature settings — and any work that we might have to do in their areas — was not detrimental to the patients."

Big six-figure savings

For HSC, the end result has been an annual saving of about $215,000 on steam and $147,000 on electricity, or one-third of a million over the 1975 figures.

From an Administrator's point of view, Mr. Long is pleased.

"Our consultants excelled. Their service and response to our inquiries was very good, budgets were on the nose and all our targets have been met."

"It looks like we'll make the estimated two-year payback period," says Jim.

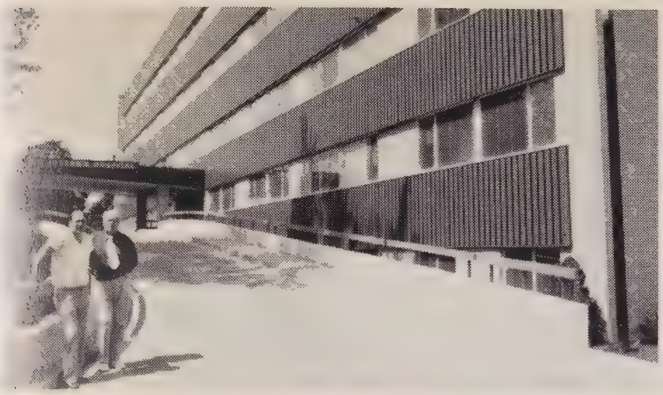
What advice for success does HSC have for other hospitals about to start their own program? First, know your own building and get full support from your administration. Next make sure the consultant you bring knows the hospital business and is capable of providing computerized simulation. Finally, appoint a full-time co-ordinator and establish a standard report format.

ENERGY COST REDUCTION — HOSPITAL FOR SICK CHILDREN

	1978 — 1979			1974 — 1975		
	Demand (KW)	Energy (KWH)	Steam 1000(LB)	Demand (KW)	Energy (KWH)	Steam 1000(LB)
September	5760	2,253,600	7,960	6560	2,854,400	11,057
October	3920	1,700,000	12,551	5200	2,656,800	14,503
November	3640	1,888,400	12,639	4680	2,351,200	18,688
December	3600	2,087,800	17,964	3760	2,279,200	22,664
January	3720	1,813,600	21,999	3760	1,993,200	26,306
February	3680	1,848,800	24,494	3760	1,964,000	24,037
March	3640	1,796,800	16,590	3760	2,156,800	24,864
April	3920	1,968,000	12,185	3760	2,060,800	20,861
May	5820	2,400,800	8,653	6400	3,072,800	9,661
June	5640	2,664,000	8,824	6960	3,364,800	11,309
July	6320	3,077,600	7,628	6720	3,977,600	9,243
August	5880	2,729,600	8,164	6720	3,538,000	11,016
Total for Year	55,540	26,229,000	159,651,000	62,040	32,279,600	204,213,600
Adjusted for added loads	53,980	25,733,000	156,900,000			
Total Energy Dollars*	394,054	347,395	712,326	452,892	435,775	927,130

*Based on 1979 rates

mpressive results at Chatham's St. Joseph's



/r. Herman and Ontario Hydro's Karl Kvas view front ntrance ramp. Snow melting load was halved from 200 W, and operation is now restricted to off-peak, midnight 6 a.m., hours.

In contrast to the Hospital for Sick Children, whose ge size called for a program utilizing advanced en- ering skills, the energy management program at St. ph's Hospital was less technically complex. Results, vever, have been equally encouraging.

"You know that an energy management program been skillfully executed as soon as you enter the spital," says Karl Kvas, a customer applications ecialist in energy conservation for Ontario Hydro in don.

With about 170 active treatment beds, St. Joseph tal area of 18,260m² (196,520 sq. ft.) It falls under group "B" hospital designation formulated by the vincial government. The 5570m² (60,000 sq. ft.) north g older section, opened in 1958, has a radiant heating tem — as does the 1050m² (11,300 sq. ft.) resident tion — energized by a gas-fired boiler. Window air ditioning units supply the cooling. The relatively new, 600m² (125,118 sq. ft.) seven year-old addition has a l environmental control system utilizing terminal re- units.

St. Joseph's enjoyed the savings coming from in- ased awareness and "freebies" that had worked so fectively for HSC, but pursued the technical hurdles in a y that enabled its own maintenance staff to handle em.

St. Joseph's chief engineer of plant operations, Fred erman, was the main spring of the program and a key ember of the 5 member energy conservation commit- e set up by the hospital's administration. While he had e technical know-how to implement the program, Mr. erman relied heavily on the employee support and the blic relations incentive generated by the other commit- e members representing all the hospital's depart- ents such as accounting, dietary, housekeeping, laun- ry and laboratory.

taff education vital

n important compliment to the program was staff educa- tion directed by Mrs. D. Dick with assistance from Ann Anderson, Linda Sokolowski, E. Makowetsky, Julie Smith, S. Lindsey, T. Herbison, Jean Bechard, Joyce Joyce, Mary Craig and Romona Hundt.

Three 1-1/2 hour sessions — in conjunction with the environmental committee — were planned for all staff members. The group meets monthly to update their programs.

These sessions resulted in lights being turned off and on, as required, and rapid acceptance of the lower lighting levels achieved when excess lamps were removed. Staff were made aware that cutting out lights also reduced air conditioning loads.

Electrical and heat energy savings

Peak load and power factor is now recorded monthly. As shown on Chart 1, power factor has increased from the low 70s in 1975 to the mid 90s and demand has consistently decreased.

A major factor in the demand decrease was a virtual halving of the snow melting equipment load — from 200 kilowatts (kW) to 100 kW — simply by separating a part of the front entrance ramp. A timer and remote switches were also installed in the boiler room to activate the snow melting equipment in the off-peak hours. The timer automatically breaks the circuit in the early hours before the load comes on, establishing a more uniform peak pattern. The load starts to rise at 6 a.m. and peaks around 10 a.m. at which time it levels off for the rest of the day, dipping again in the late evening. This enables the snow melting equipment to be turned on at midnight and shut off at 6 a.m., warming the concrete enough to melt the snow throughout the day and into the evening. If the situation warrants, it is turned back on again at midnight.

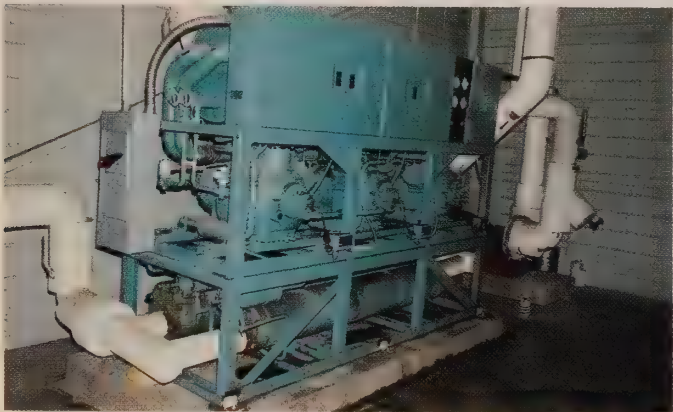
Timers were installed to shut down fans in vacant rooms — and during off-duty hours — saving both electricity and heating.

Rescheduling the operating room air supply contributed to further energy savings. The system's 35 hp motor, supplying fresh air, and the 10 hp motor, exhausting air, are now cycled in off-duty hours to run 10 minutes on and 30 minutes off, saving electrical and heat energy.

Ventilation had previously been based on a 24 hour continuous running cycle. The cycling concept reduced this running time to 10 hours, from 8 a.m. to 6p.m.. In this way, the operating room temperature is still effectively

Repainting walls and ceilings with light colours helped maintain illumination levels of 86 decalux (80 foot-candles) with a minimum of fluorescent lamps.

Interconnecting the two cooling towers made it possible to handle the load most of the time with the operation of only one of the two 300 ton water chilled absorption units.



Only under extreme high humidity and temperature conditions will the 80 ton capacity air conditioning unit cut in.

maintained without wasting energy. Exhaust air, of course, is immediately expelled to prevent contamination, but now a newly installed glycol runaround system recovers much of the heat and transfers it to the incoming air supply.

The make-up air system was modified. The discharge air temperature on the hot deck — at one time 27 to 33°C (85 - 90°F) — now operates at 24 to 29°C (75 - 85°F). The 3.8 m^3/s (8,040 cfm) air volume supplies six operating rooms and maintains a comfortable 21°C (69°F) — a not "too hot" temperature appreciated by the doctors and surgeons. Cold duct temperatures in this system were changed from a constant temperature of 12°C (54°F) discharge summer and winter to 11°C (52°F) in winter and 15.5°C (60°F) in summer.

The general air supply which discharges approximately 22m^3/s (46,600 cfm) initially had a design temperature of 13°C (56°F). This has been altered to maintain 17°C (63°F) summer and winter. In the areas affected by this unit, the thermostats have been set at 21°C (70°F) summer and winter which results in a substantial saving. Raising the setting in the summer would, of course, provide heating and cooling at the same time. The hot water heating system temperatures are kept as low as possible while still meeting comfort levels. Domestic hot water temperature was reduced to 49°C (120°F) from 60°C (140°F) for the north wing.

Savings in lighting

Because of a staff survey that was taken, it was found that many offices were overlit, some as high as 237 decalux (220 fc). These levels were reduced to 86 dalx (80 fc). In many cases, fluorescent lamps replaced incandescent lights. Repainting walls and ceilings with light colours helped maintain adequate illumination levels with reduced lighting. In certain areas, e.g., corridors, it's essential that lights be left on. In these areas, lighting was cut by installing phantom tubes in double fluorescent fixtures. The tubes repaid for themselves in 8 months. Existing four tube, four foot fluorescent fixtures were also modified by disconnecting the two centre lamps. A separate switch has also been installed in the corridor to control these lamps.

More lighting is saved, as well as heating and cooling, by keeping the lunch room closed 60 per cent of the time and by shutting off spot lights in the reception desk area. In addition, half the lamps have been disconnected in the elevator areas on each floor. Further savings are being achieved by staff who turn lamps off when they are not in use, the rewards of the educational program with staff constantly exercizing tight control over the operation of switches. Lights are even being turned off during breaks. All equipment is now turned off when not in use, even typewriters.

Most changes related to electrical were implemented by the hospital electrician, John Park.

Mechanical system savings

In the boiler plant there are three 100 therm per hour Cleaver Brooks packaged fire tubed boilers which operate at a pressure of 100 p.s.i. The combustion of these boilers is monitored weekly by the shift engineers in an attempt to maintain 0_2 levels between the range of 2.5 - 3.5 per cent without the formation of C0 gases. Because of a good water treatment program, previously formed scale on the boiler tubes has almost been completely

Blocking off the top half of the windows in this section of the hospital has a seven year payback.

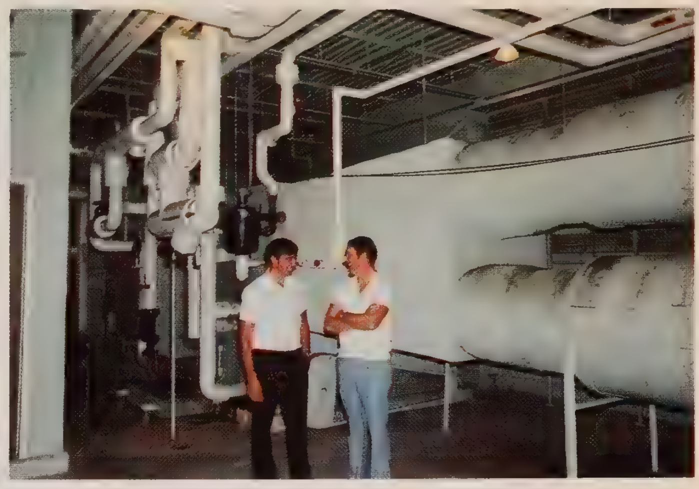
removed. Steam and condensation leaks were repaired to boost returns from 70 per cent to 90 per cent.

In the new building, air conditioning is supplied by two 300 ton water-chilled absorption units. By interconnecting the two cooling towers, chiller capacity has been increased so that one chiller now can effectively carry the load most of the time. Because of this , the second chiller is only required in extremely hot and humid weather, with a substantial saving in gas and electricity.

The installation of new "baked-on-finish" aluminum windows proved to be a major energy saving project. Payback is estimated at seven years. The old windows, 11 ft. by 5 1/2 ft. high, were halved, with the top blocked off with asphalt insulation and then panelled. This left a 2 1/2 ft. high window. While "see-through" area was halved , the corresponding tremendous heat losses were eliminated.

Over the five years of the program, energy consumption has dropped dramatically. Electricity consumption declined by 24 per cent, and natural gas consumption dropped by 27 per cent. On a cost avoidance basis, 1979 consumption remaining the same as in 1975, the cost of these utilities would have been $65,793.60 higher.

The key committee, left, Fred Herman, plant operation; Dianne Schwarz, personnel; Chairman Ken Hargreaves, laboratory; Mrs. D. Dick, staff education; and Kevin Cadeau, plant operation.



Mr. Cadeau and Mr. Herman note that glycol runaround system recovering heat from 12,000 cfm exhaust saved the most energy with the least cost.

UTILITY CONSUMPTION AND COST COMPARISON
since January, 1975

ELECTRICITY

YEAR	TOTAL K.W.H.	TOTAL COST
1975	4,129,349	$ 52,755.00
1976	3,936,117	62,737.00
1977	3,738,596	76,145.00
1978	3,208,500	65,675.00
1979	3,128,400	69,882.00

Consumption down 24% from 1975 – Cost up 32% from 1975

GAS

YEAR	TOTAL M.C.F.	TOTAL COST
1975	71,608	$ 73,956.00
1976	70,734	106,573.00
1977	66,762	116,195.00
1978	56,800	114,474.00
1979	51,984	115,058.00

Consumption down 27% from 1975 – Cost up 55% from 1975

CHART I PEAK LOAD AND POWER FACTOR FISCAL YEAR APRIL 1 to MARCH 31

	1975			1976			1977 (Installed Capacitors)			1978			1979		
	KW	KVA	PF	KW	KVA	PF	KW	KVA	PF	KW	KVA	PF	KW	KVA	PF
APRIL	765	891	86	765	762	100	576	594	97	520	550	94	520	520	100
MAY	648	904	71	558	558	100	657	702	94	520	530	98	620	645	96
JUNE	675	936	72	756	783	97	657	720	91	600	580	100	700	725	96
JULY	720	990	73	720	774	93	765	837	91	740	800	92	720	740	97
AUGUST	747	990	75	729	783	93	702	738	95	730	790	92	590	600	98
SEPTEMBER	747	1008	74	693	738	94	711	756	94	680	730	93	540	550	98
OCTOBER	594	792	75	576	576	100	594	567	97	500	515	97	525	580	90
NOVEMBER	756	873	87	558	549	100	540	549	98	520	525	99	510	570	90
DECEMBER	783	900	87	558	540	100	531	522	100	520	545	95	505	565	89
JANUARY	792	918	86	549	540	100	600	600	100	580	590	98	500	550	91
FEBRUARY	783	900	87	540	540	100	590	620	95	540	580	93	510	560	91
MARCH	783	810	97	540	540	100	570	610	93	520	520	100	510	515	99

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ENERGY MANAGEMENT

July 1980 No. 43

for the conservation of electricity

Ringing in the savings at Northern Telephone

A well-directed and long term energy management program has yielded the Northern Telephone Company total energy savings of more than $85,000 in four years.

Every year the value of the savings has increased dramatically as energy prices climb. Northern, a subsidiary of Bell Canada, serves a large part of northeastern Ontario, including the principal towns on the Trans-Canada Highway north of North Bay, and the burgeoning mining town of Timmins. The service oriented organization has more than 300 employees, and generates annual revenues of nearly $15 million.

The program to conserve energy started five years ago when Northern recognized that fossil fuel supplies were finite, and that the nation uses one third more petroleum than it produces.

The executive formed an energy conservation committee. Appointed chairman was Ron Baker, Northern's manager of buildings, vehicles and supplies.

The six member Committee represents each user group within the company to maintain good communications from all areas. As well as the chairman, it includes Leo Blais, the safety supervisor; Jim Deck, engineering associate — central office equipment planning; Vic Legault, Buildings and Vehicles Supervisor; Dick Smith, Central Office Foreman; Mike Talbot, Buildings Engineering Assistant and energy committee secretary. Adding their expertise to the committee, too, on a continuing basis, have been Napoleon Speis, Bell Canada's energy conservation engineer and Bell's Toronto energy group.

The mandate for the committee was quite simple.

The committee was to study energy use in the operation of the company and make recommendations designed to conserve energy, at the same time maintaining a high level of service to customers and providing a comfortable working environment for employees.

In addition to keeping these general rules, the committee also struck up another. It was that "members of the committee record anything they consider as energy wasters encountered during their day on their regular job (i.e., window air conditioner left on when not required; lights not turned off when they should be.)" The idea was that members would present their findings at each meeting and their items will be recorded and dealt with by the committee at regular meetings.

Five Year Payback

The committee, in making its recommendation, looks at all projects with a pay back period of up to 5 years.

Mr. Baker says, "We've been fortunate in being able to count on an enthusiastic group of employees on our committee. With the growth we've experienced in the past few years it's been difficult to keep track of our savings, but thanks to the committee's diligent work we have developed a comprehensive data sheet that enables us to express energy use in all our buildings precisely. The figures tell us how well we've been doing."

Covering the many buildings essential to the com-

The committee, from left, Mike Talbot, Ron Baker, Jim Deck, Vic Legault, and Leo Blais (missing is Dick Smith).

Photo – Joe Bouley, New Liskeard

Task lighting enjoyed by employees Dave Spence and Norma Hughes virtually eliminates the need for general lighting in the New Liskeard Work Centre telephone equipment repair room.

pany's huge service area — with 30 exchanges and 72,000 telephones — was no easy task. But committee work progressed, and as indicated by the accompanying data sheet, results have been achieved each year the program has been in operation.

The figures were categorized in terms of building function, as well as by source. The buildings that contained people, supplies, and materials were classified as non-telephone buildings. Those containing the equipment essential for the operations of the telephone company were labelled "telephone" buildings.

The use of electricity was listed separately from gas since any addition to telephone equipment would increase electrical consumption with no effect on gas consumption.

The information on energy use in the company's many buildings, and the maintenance of extensive records, is a continual source of new projects. It serves to indicate where additional work and resources should be directed.

The committee also serves in a utility function, occasionally recommending changes to improve the work surroundings, even if this results in an increase in energy consumption.

At one of the buildings in New Liskeard, for example, a combination air conditioning and air circulating system was recommended to alleviate stale air pockets found throughout the building. In this case, the central air conditioning installation will save energy since it eliminates eight existing window air conditioners and the low lighting levels are being boosted to 70 foot candles at desk level with task lighting.

The committee is also looking into methods of saving vehicle fuel. For example, a double battery system for company vehicles is being investigated that allows one battery to power flashers and a beacon when the vehicle is stopped while the other battery starts the engine. Both batteries are recharged when the engine is running.

Twice Yearly Inspection

The committee inspects all its facilities at least twice yearly, identifying areas of major concern. On these inspections, Mr. Speis will sometimes accompany the group and make recommendations.

The unique and precise reporting system enabled Northern to add another element of sophistication into their constant monitoring of building energy use . . . the degree day. Using Environment Canada's published statistics, this establishes for Northern an "energy use per square foot *per degree day.*" The buildings with high variations are carefully scrutinized to find out why their energy consumption is exceeding the established norm, which is steadily decreasing.

The latest audit of 46 buildings, for example, has shown that 29.27 Btu per square foot per degree day is now an acceptable standard. Any building over this figure is now being looked at.

There are three sections to the service area: Earlton, including the principal supply and service offices at New Liskeard and Kirkland Lake; Timmins and Kapuskasing.

Carried out to date at the New Liskeard Work Centre have been the insulation of the exterior walls of the telephone repair shop and the installation of double insulated loading doors. The lighting fixtures were lowered in the repair shop, eliminating unnecessary fixtures, and providing improved light at the work areas.

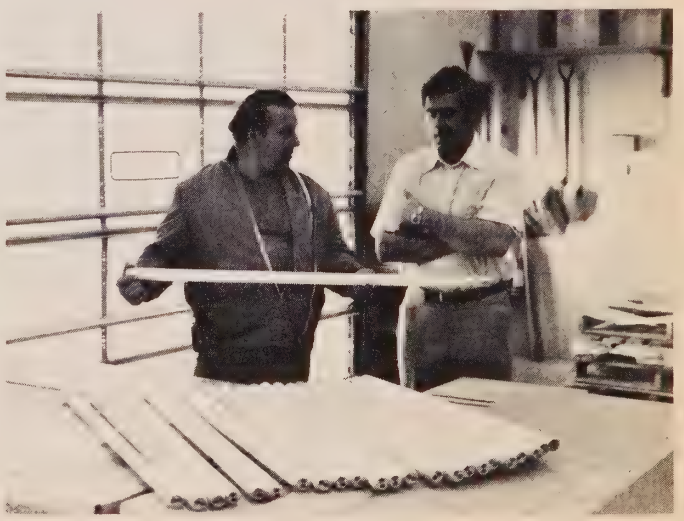
At the Centre, too, timer controls have been installed on all exterior vehicle plug-ins.

It's been recommended that all the pipes in the hot water heating system in the New Liskeard Work Centre be insulated — work which is proceeding this year — and that all fluorescent ceiling fixtures in the centre warehouse and receiving areas be lowered. In addition, "Humphrey Bogart" air circulating fans are being installed.

At the New Liskeard head office, all the 40 watt fluorescent lamps were changed to 35 watt-savers, and tamper proof covers were installed on all thermostats. In addition, timer controls are being installed on the building's heat pumps. At the company's Whitewood Avenue building, all the hot water heating system distribution pipes were insulated.

The company's Timmins Nor-Tel Centre, built in

Energy conservation committee chairman, Ron Baker, right, and maintenance department's Lee Huff check replacement 35W lamps that were installed in Northern Telephone's New Liskeard head office.



Where possible, photocell controls have been installed to control exterior lighting.

Most high ceiling areas are now equipped with air circulating fans.

1977, was modified so that timer-thermostat controls were installed on roof scupper ice melting cables, and air circulating fans put in all high ceiling areas. In addition, a separate natural gas meter was installed to monitor the consumption in the office area compared to the remainder of the building. Work is also proceeding on the insulation of all uninsulated walls at the Timmins Centre, and an improved air circulating system is planned for the administration area.

This system involves the installation of "air columns" to bring the air return grilles down to floor level. Ten separate columns will be installed and the return air diffusers in the ceiling panels will be locked. This will ensure that whatever hot air is expelled through the ceiling diffusers will make its way down to the floor and up the "air columns."

Utilize Exhaust Air

A timer control on the Nor-Tel Centre roof top unit is also contemplated. It turns off the unit at night and weekends, during the cooling season only, automatically turning itself on two or three hours before business hours. It is by-passed during the heating season to prevent freeze-up. Since the unit only has the capability of taking in fresh air, a louvred exhaust grille was suggested for the wall between the garage and administration offices above the cafeteria ceiling to take advantage of the warm air being exhausted. The motor on this grille would work in conjunction with the one on the fresh air grille in the roof top unit.

Changes were also recommended for this facility's garage. The roof mounted exhaust fans are controlled manually, but the air make-up unit is both temperature and pressure controlled (coming on only when a certain negative pressure is attained). This unit has the capability of heating incoming air. Consequently, it was suggested that a timer control be installed on the exhaust fans so that they operate at certain times of the day for not more than 15 minutes, at the same time energizing the air make-up unit. It was also recommended that the overhead space heaters be arranged near overhead doors so

Northern's Energy Conservation Data Sheet — Telephone Equipment and Non-Equipment Buildings

	1975	1976	1977	1978	1979
NAT. GAS — BOE[1]	2,643	2,981	2,582	3,102	3,150
COST OF NAT. GAS	$17,473	$25,197	$24,811	$36,985	$40,784
COST OF BOE	$6.61	$8.45	$9.61	$11.92	$12.93
BTU/SQ. FT./D.D.[2]	23.33	22.83	17.65	16.86	17.72
ELECTRICITY — BOE	1,432	1,469	1,809	1,993	1,899
COST OF ELECTRICITY	$41,655	$48,193	$72,218	$77,364	$76,257
COST PER BOE	$29.08	$32.81	$39.92	$38.82	$40.15
BTU/SQ. FT./D.D.	12.64	11.25	12.37	10.84	10.68
TOTAL BOE	4,075	4,450	4,391	5,101	5,049
TOTAL COST	$59,128	$73,390	$97,029	$114,349	$117,005
COST PER BOE	14.51	16.49	22.09	22.41	23.17
FLOOR SPACE SQ. FT.	119,282	124,138	154,415	175,946	178,738
FLOOR SPACE SQ. M.	11,086	11,537	14,350	16,352	16,611
DEGREE DAYS C°	5,983	6,626	5,968	6,589	6,264
DEGREE DAYS F°	10,769	11,927	10,742	11,860	11,275
B.T.U. PER SQ. FT.					
PER DEGREE DAY C°	35.97	34.08	30.02	27.70	28.41[3]
PER DEGREE DAY F°	19.98	18.93	16.68	15.39	15.78
EQUIVALENT KWH/SQ. FT./YEAR	63	66	52.5	53.5	52
SAVINGS TO BASE YEAR 1975	Base Yr.	$4,494	$16,989	$35,467	$28,778

1. BOE — Barrels of Oil Equivalent (Basis is 180,000 Btus per gallon, or 6.3 million per barrel).
2. In Northern's calculations, degree days are in Celsius, but floor space remains Imperial.
3. Increase due to equipment additions in buildings during 1979.

Hydro's Dave Pessah notes that roof scupper ice melting cables are now plugged into outlets connected to timer-thermostat controls.

as to blow warm air towards the doors when they are fully opened.

In the Timmins area central office, a recommendation for next year is to replace three separate wall mounted air conditioners with one main cooling coil in the existing air ventilating system. The new coil would also relieve three other basement units. This means extending existing ductwork, dropping the ceiling return air grilles for this air handling system to floor level, and putting in an exhaust system. The new cooling coil has its own roof top condensing unit with thermostat controls in the equipment room and a timer control with thermostat override to turn it off during unmanned hours (existing telephone equipment does not normally require cooling).

At the Kapuskasing area office, the energy management program found that the existing air recirculation unit was large enough to service a proposed building extension, provided a cooling coil is installed and changes are made to the fresh air supply duct work. It was also recommended that a mechanically operated exhaust system be installed on the first floor in the south wall of the building's existing repair shop. This will draw all the hot air produced by the new DMS (Digital Multiplex System) equipment through the existing equipment room and heat the old section of the building. Supply air ducts will be extended for the expansion, but the existing hot water heating system will continue to serve as the main heating plant for the entire building.

Increase Roof Insulation

Over the entire system, too, automatic set back thermostats were installed in all attended dial exchange buildings, and tamper proof thermostats were installed in all unattended dial offices. The insulation value of all roofs is also being increased to R22 as they are replaced. And, a program has been set up to test the efficiency of all furnaces in operation in all the buildings.

Overall, the system has produced consistent results. On a total energy use basis for all buildings in the system, the Btus per square foot per degree day have gone down from 35.97 in 1975, to 34.08 in 1976; to 30.02 in 1977, and 27.70 in 1978 before nudging up to 28.41 in 1979 because of equipment additions in some buildings. Biggest saving during the five year period was in the use of natural gas, which dropped from 23.33 Btus per square foot per degree day all the way down to 17.72. Electricity consumption dropped from 12.64 Btus per square foot per degree day to 10.68.

The best results were obtained in the non-telephone equipment buildings. Energy consumption dropped from 35.34 Btus per square foot per degree day in 1975 to 28.36 in 1979. Cost avoidance savings amounted to $22,708 in 1978, or a net saving of $55,554 since 1975. In the telephone equipment buildings, energy usage dropped from 36.84 Btus per square foot per degree day to 28.48, representing a cost avoidance of $12,759 in 1978 or a net saving of $30,174 since 1975. The Energy Committee feels that these savings are substantial since they take into account the new equipment installed each year.

Technical Advisor: George L. Robertson
Editorial: Brian Lee

Fluorescent lamps were removed from alternate fixtures in the lighting rows at the New Liskeard Work Centre & Warehouse.

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ENERGY MANAGEMENT

January-February, 1981 No. 45

for the conservation of electricity

Garrett's on-target energy management program adds up to $630,000

"Energy, being an essential — if not the most essential — part of the economic and social development of all nations, requires the concentrated attention of all countries in its management. In our particular case, our concern as a company was the need to conserve energy at all levels of political, industrial and individual usage if we as a nation were to become energy self-reliant and prevent shortages in the years ahead."

W. C. Tate, Vice-President, Garrett Manufacturing Limited.

The enthusiasm, drive and determination that propelled Garrett Manufacturing Limited from a church basement operation to a $50 million a year manufacturing enterprise has powered its energy management program into a $630,000 success.

That's the saving in utility costs the metropolitan Toronto firm, specializing in electronic control systems, accumulated in just three and a half years. The largest portion was for electricity and natural gas but considerable savings were made on water bills.

The savings are more than triple the cost of implementing the necessary measures and represent the calculated cost avoidance compared to the established base year of 1976. Garrett spent an estimated $180,000 putting the program into place and maintaining it over the first three years. Even the most costly expenditures were paid back within a year.

An unusual aspect of Garrett's success is that unlike Canadian industry in general, the company spends only 1.2 per cent of its total operating costs on energy for its plants and offices and to produce its goods. It's people intensive.

Garret — a subsidiary of a U.S. aerospace technology company — employs over 1000 people in operating six manufacturing plants in Etobicoke. They make integrated circuits for computer use and temperature controls for both communication and aerospace system application. As a matter of fact, 75 per cent of the world's commercial and military aircraft temperature control systems are made in Etobicoke. Garrett provides regenerative equipment and electronic systems for the Toronto Transit Commission's new subway cars and light rail vehicles and has developed an alarm control unit for the CANDU nuclear reactor. The unit will be used by Ontario Hydro in its reactors at the Pickering "B" and Bruce "B" generating stations.

Fifteen per cent target set

In 1976, Garrett's Vice-President and General Manager, W. C. (Bill) Tate, pledged to put in place an effective energy conservation program that would put the company in the position of helping this country along the road to energy self-reliance. The voluntary target was a 15 per cent reduction in energy use per unit of output by the end of 1980, compared to 1974 consumption figures.

Says Mr. Tate, "Energy conservation may be a matter of economics today, but tomorrow it could be a matter of corporate survival. We can't afford not to put people on energy conservation."

Garrett set its target to follow goals laid down by the Federal government's voluntary program for industry which set up 17 task forces. It's one of the 1,100 member companies in the Transportation Sector, Manufacturing Task Force. Garrett is also participating in the Air

Energy conservation, a byword at Garrett, is highlighted by these two employee pool vans parked in front of the head office. The company has three, all helping to reduce gasoline consumption per employee.

Industries Association of Canada energy conservation program. The industry task forces were first organized in 1975 and represent about 80 per cent of Canada's industrial energy users. By the end of 1978, the combined industry task forces were only 1.3 percentage points away from the year-end 1980 goal of a 12 per cent reduction in energy use.

Garrett also participates in the energy conservation programs of the Electrical and Electronic Manufacturer's Association and with the Canadian Manufacturer's Association.

The program

The selection of an energy management co-ordinator was almost more important than setting the targets. In naming the Production and Plant Manager, Ward Tomlin, to this position, Mr. Tate said, "Energy conservation can become a grinding and discouraging job. It takes very devoted individuals to carry it through successfully."

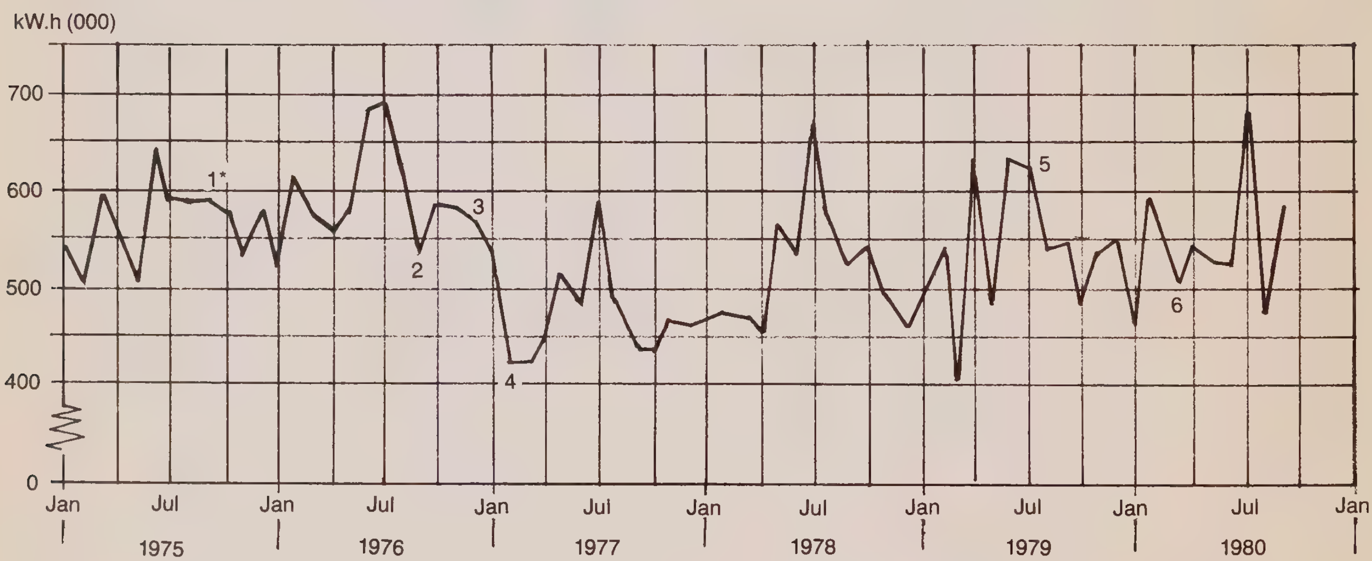
While Mr. Tate continued his interest in the program, checking progress and spurring personnel to greater efforts. Mr. Tomlin began broadening the initial commitment.

"The success of an energy management program," says Mr. Tomlin, "is ultimately determined by the involvement of the employees — the engineers, the sales force, the office personnel, the machine operators — the people who close the doors, turn off lights, and switch off equipment. These employees in turn look to supervisory staff and management to gain the commitment they need before becoming involved."

Energy saving night set-back thermostat is checked by Garrett's assistant supervisor of plant engineering, Andy Speers.

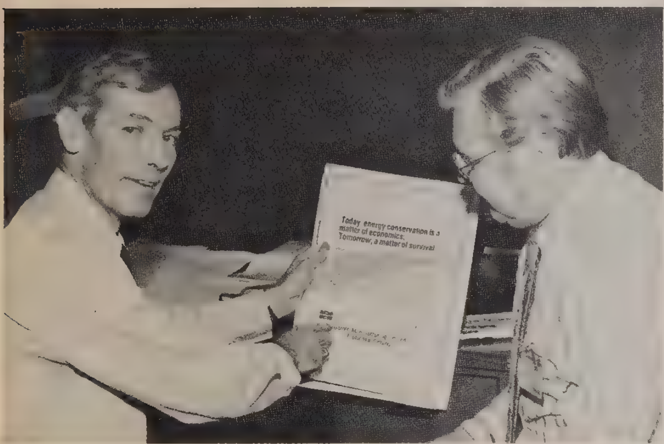
Mr. Tomlin formed an energy conservation and management committee, using it to involve all employees in both the evaluation of the program and in reviewing energy saving progress. It's a method that also helps employees in re-evaluating original goals, if necessary, and in revising them, if possible.

Fig. 1 — MONTHLY CONSUMPTION IN kW.h — ALL GARRETT FACILITIES



1. Marmac bldg. completed
2. Racine bldg. closed, Marmac bldg. fully occupied (34,000 sq.ft. addition)
3. Capacitors installed in Marmac
4. Taber Road bldg. occupied (10,300 sq.ft. addition)
5. 254 Attwell bldg. purchased
6. 254 Attwell occupied (32,300 sq.ft. addition)

Numbers indicate plant additions. (Despite successive expansions, electrical consumption remains constant)



A key element in Garrett's success was motivating employees to support and participate in the program. A special opening week "extravaganza" kicked-off the program, employee ideas and suggestions were encouraged by contests and awards, and program publicity was expanded to include the surrounding community.

Appointed to the committee were the manufacturing managers and industrial and plant engineering managers. In addition, representatives from purchasing, quality assurance, design engineering, and other key areas of the company were appointed on an "as required" basis.

Mr. Tomlin explains that managers are essential to the committee so that they can inform supervisors about the economic benefits of the program and hold them accountable for the energy used in their areas of control. This is critical in establishing that the program's success depends on the people who get the day-to-day work done.

After the program was officially started, this committee met monthly, setting guidelines to formulate and conduct an energy audit, defining attainable guidelines, and developing ideas on ways to save. Incorporated in the audit was an evaluation of the fuel intensity of each item of the company's output. The committee also enlisted employee support and participation, disseminated the collected information and produced a standard energy accounting system.

Finally, the committee attempted to provide leadership by example and communicated the objectives and results to both management and employees in each part of the company.

"An internal publicity program is only common sense since it's only natural employees must be convinced before they will respond to any management introduced program," says Mr. Tomlin.

Since the most powerful form of management support is by example, this was reinforced by the company taking positive actions based on the initial energy audit findings, and which were readily apparent to employees. These included:

1) Evaluated lighting levels and reduced where possible.
2) Double glazed window areas.
3) Sealing doors and windows.
4) Installation of night set-back thermostats.

When Garrett put its energy management program into effect in the summer of 1976, positive results of the program became apparent immediately. Figure 1 shows the effect of the program on electrical consumption. The July peak load due to air conditioning requirements had subsided and the energy conservation measures were coming on stream. The company was growing, with 76,600 sq. ft. of new plant added by the end of 1979, and yet consumption was dropping. The effect was most noticeable in the difference in July peak consumption figures at the start of the program — from 691 thousand kW.h in 1976 to 570 thousand kW.h in 1977.

The employee's awareness kick-off

The energy management committee's first program was to kick-off the employee's awareness program — a "Hollywood style" extravaganza. This approach had worked well years before when Garrett instituted a "zero defects" program. The company:

- handed to all employees "Energy is precious, conserve it" lapel buttons, and reprints of a full page advertisement in the local paper
- broadcast public interest radio messages on a local station
- made available automobile mileage stickers
- supplied cafeterias with coasters, imprinted with energy conservation messages, and tent cards for putting on office desks, shop benches, and reception areas
- issued "Energy is precious" decals and "90 kilometres an hour" driving stickers to truck fleets
- placed "Please turn off when not in use" stickers on office equipment, shop machines, light switches, and water taps and put similar signs in key areas
- hung banners throughout the building announcing energy conservation week
- used suitable stencil overprints in postal machines to encourage supplier and customer participation
- set up suggestion boxes to solicit energy conservation ideas
- made available pamphlets and booklets in cafeterias and lunch rooms
- prepared and used news items for the in-plant newspaper

94 per cent response!

The activity paid off. There was a 94 per cent response to the pledge cards distributed in pay envelopes, asking employees to sign as an indication of their willingness to participate in the program. Pay envelopes were regularly used to distribute energy conservation awareness messages soliciting more energy saving ideas. These ideas — and those in the suggestion box — poured in. The committee had a flood of them to consider and report on. These were treated in a "suggestion plan" manner and workable ideas were rewarded with $10 to $25.

A special "energy management office" was set up to assist employees. This was not only stocked with the latest in free information from Ontario Hydro, government, and other sources, but also included a film library. The films were shown to employees as part of the overall effort, too. In addition, comparative graphs of energy use, and of the goals and accomplishments of the program, were posted regularly on bulletin boards in prominent locations. A section of the employees' magazine was also devoted to energy conservation publicity. Finally, a poster contest was developed for employees' children. In this way, many of the employees began practising energy conservation at home

Still another incentive was the setting up of an award program recognizing an individual or identifiable group of individuals for achieving the most significant saving or suggested improvement during the prior three month period. The idea had to affect energy conservation either within the plants and offices or in the products produced. Judges were the company's Energy Conservation Task Force Committee.

External publicity helps too

Garrett also set up an external publicity campaign to augment the internal effort by reflecting Garrett's concern to employees during those hours they were away from the job. At the same time, this also informed associates of the company about its energy conservation activity. This was done by purchasing outdoor advertising space and full page newspaper and magazine space. Garrett also offered tours of its facilities showing energy conservation being practised. Local schools and colleges were supplied with energy conservation publicity materials and school essay contests were arranged. A welcome side benefit of this activity was an increase in student job applications.

This outside community activity neatly tied in with Garrett's work with the Transportation Industry task force, since the company undertook to publish a regular "Idea Exchange" newsletter for this group. Write Ward Tomlin at Garrett Manufacturing Limited, 255 Attwell Drive, Rexdale, M9W 5B8 for a copy, or to be put on the mailing list.

One other element of this side of the program was sponsorship and attendance at the seminars, and Garrett's hosting of energy conservation meetings.

Meanwhile, back at the shop

Back at Garrett's senior management levels, more formal and practical plans for energy conservation were being worked out. All projects were analyzed and priorities established with both immediate and long range results being anticipated.

Downdraft ceiling fans utilize most of the heat already in the building by improving interior air circulation, thereby saving energy.

Timer used in the operation of this Garrett air compressor is a useful energy saving industrial application.

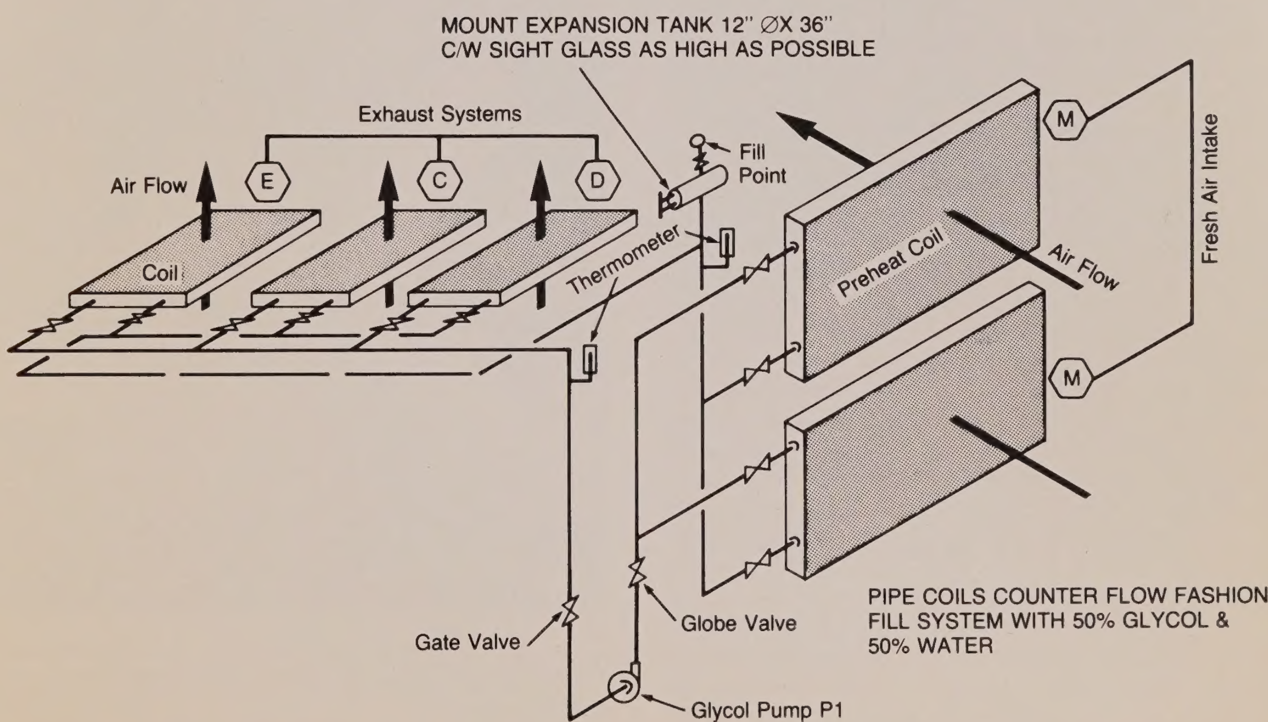
Homing in on the "freebies", Garrett established procedures to ensure that everything that was not being used was turned off. Security guards were instructed to turn off all key-operated systems between 4:30 p.m. and 5:00 a.m.

Energy use in each of the six buildings was tackled. Certain areas which require a controlled environment (data processing rooms) were zoned in order to meet specific heating and cooling requirements. In order to have more control over energy usage, offices, print rooms and test laboratories were also isolated. Zoning these various buildings has resulted in energy cost savings.

Heating requirements were reduced through the use of added insulation. In Garrett's newest building at 254 Attwell Drive, formerly a warehouse, three inches of styrofoam insulation was applied to the walls and payback was estimated at 18 months. In this building, too, 3½ inches of fibreglass was set on top of the false ceiling for additional economies. Thermopane windows were installed in some buildings and a few 1/8th inch transparent polypropylene windows were put in on a trial basis and later removed because of the lack of transparency. Good use was made of "Humphrey Bogart" ceiling fans which utilized most of the heat already in the building by improving interior air circulation.

In the 50,000 sq. ft. building at 251 Attwell, the heating system was modified at a cost of $30,000 to minimize energy requirements for heating. Heat from the exhaust air of the wave soldering units is reclaimed using a glycol runaround system. The glycol is heated and then pumped to the make-up air unit of the building's air conditioning system thereby eliminating the need for heaters on the make-up air unit. (See Fig. 2)

Fig. 2 — GLYCOL HEAT RECLAIM SYSTEM



A procedure was put in place ensuring that all work bench lighting levels did not exceed 100 foot candles. Lighting, in general, was arranged to maximize its efficiency and to avoid glare, and, at 120 work stations, was reduced by replacing 100 watt bulbs with 60 watt bulbs. Fixtures were removed from overlit offices and in some cases, four fluorescent tubes were replaced with two U-tubes. Where possible, task lighting was instituted. This appealed to some of the employees, who encouraged others to adopt its use.

Timers were installed to control air compressor operation and solenoids were put in to control water flow. Savings on both the electric and water bills were substantial since compressors and water taps had been left to run continuously. Some outdoor lighting was reduced by installing photocell controls.

An analysis of the electric bill revealed that the power factor was generally low. It was especially poor (0.595) in the Marmac building containing the facility for testing subway equipment. Occasionally used in the testing is a 900 kilovolt-ampere rectifier. A bank of 475 KVAR, 3 phase, 600 V capacitors was installed in this building at

A bank of 600 V, 3 phase capacitors, examined by plant engineering superintendent Roy Smith, left, and assistant supervisor of plant engineering, Bryce Eldridge, boosted the plant's power factor from under .60 to well over .90.

a cost of $5150. They successfully increased the power factor to 0.90, eliminating a monthly $195 power factor penalty. Presently, the power factor is a spectacular 0.98.

Because of the large window area of the 'Engineering building' at 254 Attwell, it was necessary to double glaze the entire glass area. The double glazing has resulted in a net gas savings of 200 MCF per annum. To save energy, drapes were added to the window areas. One of the tangible benefits of the large window area is the reduced need for lighting. An intangible benefit is the improved work environment through the use of natural light and view of the outside environment.

Van and car pools

In efforts to reduce gasoline consumption per employee, Garrett instituted van and car pools. The only company requirement for forming a van pool is that at least eleven people participate (including the driver). The vans carry 11 people who are charged $38 monthly. This is considerably less than the weekly cost of operating a car, reducing each employee's travelling costs. With the success of the first three, Garrett has ordered two more. The vans are owned and maintained (tune-ups, oil changes, tires, etc.) by the company. The car pools, pretty well left to the employees to organize, are encouraged by the company. Both car and van pools receive preferred parking spaces in the parking lot, and both help reduce the strain on Garrett's parking facilities.

To sum up

Several axioms emerged as a result of Garrett's successful energy management program.

One of the most important is that sustaining a program requires constant nourishment to promote any kind of development. Another, is that a project and idea list must be instituted and maintained.

A must is the calculation of energy use by unit of production. This should be done before the energy program is established and monitored while the program is in progress. Monthly calculation records are recommended.

Worthwhile remembering is that outside consultant services should be considered — as necessary — in special situations. And certainly, the primary key to saving money through energy conservation is employee motivation and participation.

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